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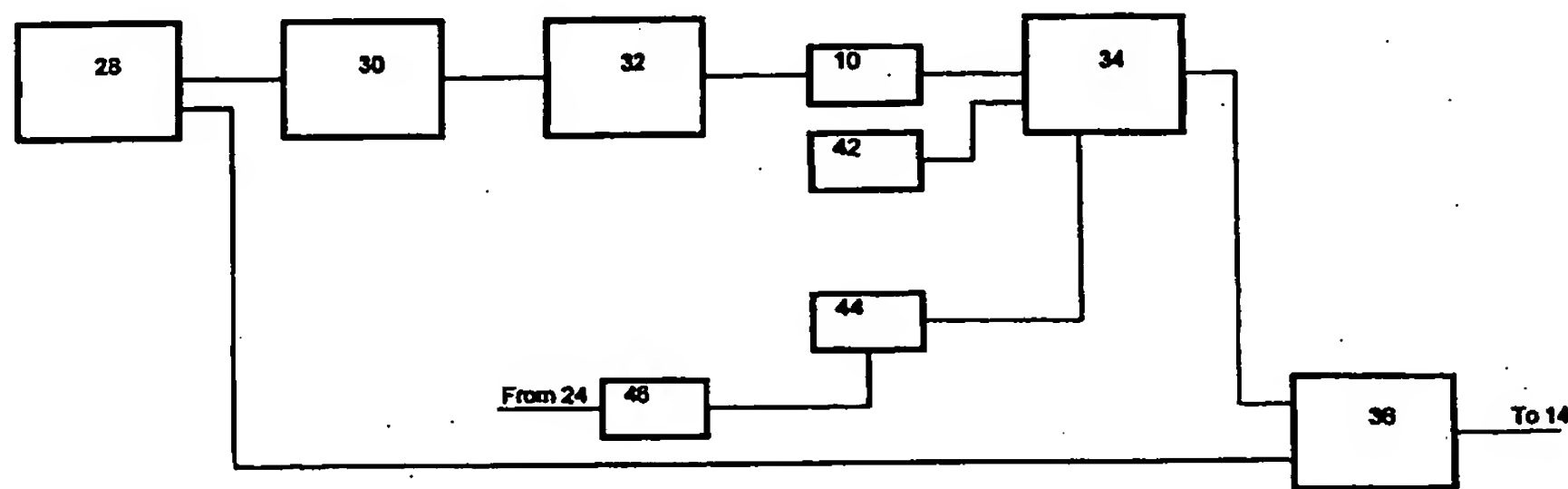
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(54) Title: **A HIERARCHICAL RELATIONAL DEFINITION SYSTEM AND A METHOD OF DEFINING AN OBJECT**



28

(57) Abstract

A hierarchical relational definition system (26) for defining an object is provided in which a user is presented with a plurality of menus from which selections are made, whereupon the system references a database (10) to obtain information about an object corresponding to said selections, the data including control data to determine whether a formula is to be referenced to calculate further data, and provides an output including information about said object. The system is useful in cost estimate engineering to provide estimates of man-hours to install materials. The system also has a formula adjustment mechanism (44, 46) to refine the formulae according to any variation between the actual man-hours and the calculated man-hours.

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TITLE

"A Hierarchical Relational Definition System and a Method of Defining an Object"

TECHNICAL FIELD

- 5 This invention relates to a hierarchical relational definition system and a method of defining an object.

BACKGROUND ART

Literally, cost estimate engineering is the preparation of a cost estimate for an engineering project. A cost estimate typically comprises two components, direct  
10 costs and indirect costs.

Indirect costs include such things as site supervision, site engineers, plant and equipment hire, insurance and so forth. Whilst indirect costs are not negligible, in most engineering projects, direct costs constitute the bulk of the costs.

Direct costs consist of the materials used in the project and labour required to  
15 install the materials. Typically, the materials are organised as a bill of materials, which is a list of every material item required for the engineering project.

To produce a direct cost estimate, the labour required to install the materials in the bill of materials is estimated. Whilst information on materials for engineering projects exists, estimating the labour required to install a material has  
20 predominantly been based on the judgement of the cost estimate engineer. Thus, there has been a risk of inconsistencies in cost estimates, due to different judgements of cost estimate engineers in relation to the labour required for a particular material or the differing judgement of the same cost estimate engineer on a day to day basis.

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Heretofore it has been unknown to have an integrated structured system with on-line databases to assist a cost estimate engineer in preparing multi-disciplined direct and indirect cost estimates at order of magnitude, budget and/or definitive level.

- 5 It is believed that such a system would have many advantages, including that it would provide a level of consistency in the labour estimates appearing in the direct cost estimates.

### SUMMARY OF THE INVENTION

- 10 In accordance with one aspect of this invention, there is provided a hierarchical relational definition system for defining an object, comprising:

interface means that sequentially presents a plurality of menus from which selections are made, each selection forming an input parameter, said input parameters corresponding to an object;

- 15 indexing means which forms an index from at least one of the input parameters;

database means including fields in which data relating to said object is stored, one of the fields including control data;

referencing means arranged to reference the database means using the index to obtain therefrom the data relating to the object;

- 20 processing means responsive to said control data, said control data including instructions to control whether the processing means references a formula and calculates further data relating to said object; and

output means for creating an output corresponding to at least one of the input parameters and/or at least some of the data and the further data, if any, said output defining the object.

Preferably, each combination of input parameters represents a different object.

- 5 Preferably, only one selection is made from each menu.

Preferably, the index is formed from a plurality of the input parameters. In a preferred arrangement, the index is formed from the concatenated values of the plurality of input parameters.

- 10 Preferably, the hierarchical relational definition system includes a formulae database referenced by the processing means to obtain the formula.

Preferably, the hierarchical relational definition system is provided with a formulae adjustment database, in which adjustments to each formula in the formulae database are stored, said processing means also referencing said formulae adjustment database when calculating the further data.

- 15 Preferably, the hierarchical relational definition system is provided with a comparison means, responsive to the output and to actual data provided by a user corresponding to actual values of the further data, the comparison means altering the adjustment corresponding to the object in the formulae adjustment database to reduce any difference between the actual data and the further data.

- 20 In one arrangement, the processing means is also responsive to at least one of the input parameters and/or at least some of the data when calculating the further data.

In one arrangement, the database means and the formula adjustment database each comprise a table.

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Preferably, the output means comprises table generation means which produces a table comprising at least one row, each row corresponding to an object and containing the input parameters and the further data.

5 Preferably, the control data includes information as to whether a user is to be asked to enter data relating to the object.

According to another aspect of the present invention, there is provided a method for defining an object, comprising the steps of:

sequentially presenting a plurality of menus from which selections are made;

10 forming an index from at least one of the selections;

referencing a database using the index to obtain therefrom data relating to the object, some of said data being control data;

15 determining from said control data whether to reference a formula to calculate further data relating to the object, and if so, referencing said formula and calculating said further data; and

presenting at least one of the selections and/or at least some of the data and the further data, if any, as an output, wherein the output defines the object.

Preferably, the index is formed from a plurality of the selections.

20 Preferably, the method includes the step of referencing a formulae adjustment database to obtain therefrom an adjustment for said formula, which is utilised in calculating the further data.

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Preferably, the method includes the step of comparing the further data with an actual value provided by a user, and on the basis of the comparison altering the adjustment corresponding to the object to reduce the difference between the further data and the actual value.

5

### BRIEF DESCRIPTION OF THE DRAWINGS

This invention will now be described with reference to one embodiment thereof and the accompanying drawings in which:-

Figure 1 is a functional block diagram of a cost estimate engineering software package of the embodiment;

10

Figure 2 is a functional block diagram of a hierarchical relational definition system incorporated in the cost estimate engineering software package of the embodiment;

Figure 3 is a flowchart of the hierarchical relational definition system shown in figure 2; and

15

Figure 4 shows the tree menu structure utilised in the hierarchical relational definition system of Figure 2.

### DETAILED DESCRIPTION OF THE DRAWINGS

Whilst the invention is applicable to other areas, the embodiment is directed toward use in cost estimate engineering and the method of providing a cost  
20 estimate using the same. The embodiment is implemented as a software package executing on a computer.

The cost estimate engineering software package of the embodiment comprises a reference database 10, a bill of materials module 12, a direct cost estimate module 14, a direct cost historical database 16, a direct cost historical



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adjustment database 17, an indirect cost estimate module 18, an indirect cost historical database 20, an indirect cost historical adjustment database 21, an estimate summary 22 and a project cost control module 24, and a cost comparison means 25.

- 5 The bill of materials module 12 is formed as a hierarchical relational definition system 26 comprising an interface means 28, an indexing means 30, the reference database 10, a referencing means 32, a processing means 34 and an output means 36.

The interface means 28 presents a plurality of menus from which a user can  
10 make selections according to the material the user requires.

Cost estimate engineering usually involves estimating costs for a variety of different materials from a number of engineering disciplines. To accommodate this, there is more than one plurality of menus, each plurality being for each category of materials. In addition, the number of menus in each plurality of  
15 menus varies depending upon how many selections are required to uniquely identify the material. Thus, the number of menus will vary according to whether the type of required material is a piping material, an electrical engineering material or a structural engineering material.

Each of the plurality of menus has certain characteristics in common. Each  
20 plurality of menus has one or more menus in which the user's selections are used by the indexing means 30 to form the index. The number of such menus and the information presented in those menu varies from material category to category.

In addition, each plurality of menus may have a number of menus, that are not  
25 utilised by the indexing means 30 but which are required in order to uniquely identify the material for the purposes of the bill of materials and also for ordering purposes.

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Whether or not a menu is used by the indexing means 30 depends upon whether the information provided in the menu influences the further data calculated by the processing means 34. In the embodiment, the further data is man-hours required to install the material. Consequently, menus which contain  
5 information that influence the man-hours required to install the material are used by the indexing means 30, whereas menus which contain information that does not affect the man-hours required to install the material, such as material finish, are not used by the indexing means 30.

In this regard, it should be appreciated that the information in the menus used by  
10 the indexing means 30 may or may not directly appear in the formula used to calculate the man-hours, but the information is necessary to uniquely identify the material and to form the index that is used to reference the data for that material, which data maybe utilised in the formula.

In the present embodiment, the menus are presented in a tree structure, so that  
15 the options presented to the user in the second menu depend upon the selection made in the first menu, and so forth.

Whilst it should be appreciated that menus for various categories of materials can be provided, in the present embodiment the menus presented are in respect of carbon steel piping to American standards and are shown in Figure 4. The  
20 diagram in Figure 4 is a tree diagram of the menu structure. Nine menu levels are shown, entitled Comp (component), Type (joining type), Details (45° elbow, t-piece, etc), STDS (the specific standard of manufacture), Grade, Finish, Rating, Schedule and Size. Of these menus, the selections made in the Comp, Details, Rating, Schedule and Size menus are used by the indexing means 30 to  
25 form the index.

Having selected carbon steel piping to American standards, a user is initially presented with the component menu M8 from which one of three options are selected. The numbers present in Figure 4 are for illustrative purposes only,

but in the actual embodiment, a user is presented with meaningful descriptions. A table of the descriptions presented to the user corresponding to each of the menu options for each menu in Figure 4 is presented as a table below. For the sake of brevity, menus with numerous items have only some of the items shown in the table below. Where items have been omitted, ellipses are shown in the table.

MENU SYSTEM			CARBON STEEL TO AMERICAN STANDARDS		
M1-1	GROUP	1	1 C S (CARBON STEEL TO AMERICAN STD.)	M2	2
M1-2	GROUP	1	2 A S (ALLOY STEEL TO AMERICAN STD.)	M2	
M1-3	GROUP	1	3 S S (STAINLESS STEEL TO AMERICAN STD.)	M2	
M1-4	GROUP	1	4 S T (STEEL PIPE TO AUSTRALIAN STD.)	M2	
M1-5	GROUP	1	5 D I (DUCTILE IRON PIPE)	M2	
M1-6	GROUP	1	6 C U (COPPER PIPE)	M2	
M1-7	GROUP	1	7 V P (VICTAULIC PIPE)	M2	
M1-8	GROUP	1	8 P V (PLASTIC PIPE)	M2	
M2-1	COMPONNT	2	A PIPE	CS3A1	3
M2-2	COMPONNT	2	B FITTINGS	CS3B1	28
M2-3	COMPONNT	2	C FLANGES	CS3C1	236
M2-4	COMPONNT	2	D VALVES	CS3D1	
M2-5	COMPONNT	2	E BOLTS	CS3E1	398
M2-6	COMPONNT	2	F GASKETS	CS3F1	527
M2-7	COMPONNT	2	G SPECIALS	CS3G1	
M2-8	COMPONNT	2	H SUPPORTS	CS3H1	
CS3A1	TYPE	3	1 BEVELLED ENDS	CS4A1	4
		3	2 PLAIN ENDS	CS4A1	4
CS4A1	DETAILS	4	1 SEAMLESS	CS5A1	5
		4	2 ELECTRIC RESISTANT WELDED	CS5A2	6
		4	3 DOUBLE SUBMERGED ARC WELDED	CS5A3	7
		4	4 BUTT WELDED	CS5A3	7
CS5A1	STD.(DIM.)	5	1 ANSI B36.10	CS6A1	8
CS5A2	STD.(DIM.)	6	1 ANSI B36.10	CS6A2	9
CS5A3	STD.(DIM.)	7	1 ANSI B36.10	CS6A3	10
CS6A1	STD.(MAT.)	8	1 API 5L	CS7A1	11
		8	2 ASTM A106	CS7A1	11
		8	3 ASTM A53	CS7A2	12
		8	4 ASTM A333 (LOW TEMP.)	CS7A3	13
CS6A2	STD.(MAT.)	9	1 API 5L	CS7A1	11
		9	2 ASTM A53	CS7A2	12
		9	3 ASTM A333	CS7A3	13
CS6A3	STD.(MAT.)	10	1 API 5L	CS7A1	11
		10	2 ASTM A53	CS7A2	12
CS7A1	GRADES	11	1 GRADE A	CS8A1	14
		11	2 GRADE B	CS8A1	14
CS7A2	GRADES	12	1 GRADE A	CS8A2	15
		12	2 GRADE B	CS8A2	15
CS7A3	GRADES	13	1 GRADE 6	CS8A1	14
CS8A1	FINISH	14	1 BLACK	CS9AN1	16
CS8A2	FINISH	15	1 BLACK	CS9AN1	16
		15	2 GALVANISED	CS9AN1	16
CS9AN1		16	1 NOT APPLICABLE	CS10A1	17
CS10A1	SCHEDULE	17	1 STANDARD WEIGHT	CS11A	18
		17	2 EXTRA STRONG	CS11A	18
		17	3 DOUBLE EXTRA STRONG	CS11B	19
		17	4 SCHEDULE 10	CS11C	20
		17	5 SCHEDULE 20	CS11D	21
		17	6 SCHEDULE 30	CS11E	22

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		17	7	SCHEDULE 40	CS11F	23
		17	8	SCHEDULE 60	CS11G	24
		17	9	SCHEDULE 80	CS11H	25
		17	10	SCHEDULE 100	CS11G	24
		17	11	SCHEDULE 120	CS11I	26
		17	12	SCHEDULE 140	CS11G	24
		17	13	SCHEDULE 160	CS11J	27
CS11A	SIZES	18	1	6		
		18	2	8		
		18	3	10		
		18	4	15		
...	...	...	...	...	...	...
		18	30	900		
		18	31	1050		
CS11J	SIZES	27	1	15		
		27	2	20		
		27	3	25		
		27	4	32		
...	...	...	...	...	...	...
		27	19	550		
		27	20	600		
CS3B1	TYPE	28	1	BUTT WELDED	CS4B1	29
		28	2	HIGH PRESSURE SCREWED	CS4B2	30
		28	3	HIGH PRESSURE SOCKET WELD	CS4B3	31
		28	4	HIGH PRESSURE UNIONS	CS4B4	32
		28	5	HIGH PRESSURE REDUCER INSERTS	CS4B5	33
		28	6	HIGH PRESSURE TUBULARS	CS4B6	34
		28	7	OUTLET FITTINGS	CS4B7	35
CS4B1	DETAILS	29	1	ELBOWS 90 DEGREE LONG RADIUS	CS5B1	36
		29	2	ELBOWS 45 DEGREE LONG RADIUS	CS5B1	36
		29	3	TEES EQUEL	CS5B1	36
		29	4	RETURNS 180 DEGREE LONG RADIUS	CS5B1	36
		29	5	CAPS	CS5B2	37
		29	6	TEES REDUCING	CS5B3	38
		29	7	REDUCERS CONCENTRIC	CS5B3	38
		29	8	REDUCERS ECCENTRIC	CS5B3	38
		29	9	ELBOWS 90 DEGREE SHORT RADIUS	CS5B4	39
		29	10	RETURNS 180 DEGREE SHORT RADIUS	CS5B4	39
CS4B2	DETAILS	30	1	ELBOWS 90 DEGREE	CS5B5	40
		30	2	ELBOWS 45 DEGREE	CS5B5	40
		30	3	TEES EQUEL	CS5B5	40
...	...	...	...	...	...	...
CS4B3	DETAILS	30	12	TEES REDUCING	CS5B8	43
		31	1	ELBOWS 90 DEGREE	CS5B9	44
		31	2	ELBOWS 45 DEGREE	CS5B9	44
		31	3	TEES EQUEL	CS5B9	44
		31	4	CROSSES	CS5B9	44
		31	5	COUPLINGS FULL	CS5B9	44
		31	6	COUPLINGS HALF	CS5B9	44
		31	7	CAPS	CS5B9	44
		31	8	TEES REDUCING	CS5B10	45
CS4B4	DETAILS	32	1	UNIONS SCREWED	CS5B11	46
		32	2	UNIONS SOCKET WELD	CS5B11	46
CS4B5	DETAILS	33	1	REDUCER INSERTS TYPE 1	CS5B12	47
		33	2	REDUCER INSERTS TYPE 2	CS5B12	47
CS4B6	DETAILS	34	1	SWAGE NIPPLES CONCENTRIC LESC/SESC	CS5B13	48
		34	2	SWAGE NIPPLES CONCENTRIC LESC/SEPE	CS5B13	48
		34	3	SWAGE NIPPLES CONCENTRIC LESC/SEBE	CS5B13	48
		34	4	SWAGE NIPPLES CONCENTRIC LEPE/SESC	CS5B13	48
...	...	...	...	...	...	...
		34	23	PIPE NIPPLES PE/BE	CS5B14	49
		34	24	PIPE NIPPLES BE/BE	CS5B14	49
CS4B7	DETAILS	35	1	WELDOLETS	CS5B15	50
		35	2	LATROLETS BUTT WELD	CS5B16	51
		35	3	ELBOLETS BUTT WELDS	CS5B16	51
...	...	...	...	...	...	...
		35	11	NIPOLETS PLAIN END	CS5B20	55
CS5B1	STD.(DIAM.)	36	1	ANSI B16.9 (TO 600 DIA.)	CS6B1	56
		36	2	MSS-SP48 (ABOVE 600 DIA.)	CS6B2	57
CS5B2	STD.(DIAM.)	37	1	ANSI B16.9 (TO 600 DIA.)	CS6B3	58
		37	2	MSS-SP48 (ABOVE 600 DIA.)	CS6B4	59
CS5B3	STD.(DIAM.)	38	1	ANSI B16.9 (TO 600 DIA.)	CS6B5	60

CS5B4	STD.(DIAM.)	38	2	MSS-SP48 (ABOVE 600 DIA.)	CS6B6	61
...	...	39	1	ANSI B16.28	CS6B7	62
CS5B19	STD.(DIAM.)	54	1	ANSI B16.11	...	...
CS5B20	STD.(DIAM.)	55	1	ANSI B16.11	CS6B22	77
CS6B1	STD.(MAT.)	56	1	ASTM A234	CS6B23	78
...	...	56	2	ASTM A420 (LOW TEMP.)	CS7B1	79
CS6B2	STD.(MAT.)	57	1	ASTM A234	CS7B2	80
...	...	57	2	ASTM A420 (LOW TEMP.)	CS7B3	81
CS6B3	STD.(MAT.)	58	1	ASTM A234	CS7B4	82
...	...	58	2	ASTM A420 (LOW TEMP.)	CS7B5	83
CS6B23	STD.(MAT.)	78	1	ASTM A105	CS7B6	84
...	...	78	2	ASTM A350 (LOW TEMP.)	...	...
CS7B1	GRADES	79	1	WPA	CS7BN8	120
...	...	79	2	WPB	CS7B35	121
CS7B2	GRADES	80	1	WPL6	CS8B1	122
...	...	...	...	...	CS8B1	122
CS7B35	GRADES	121	1	LF3	CS8B1	122
CS8B1	FINISH	122	1	BLACK	...	...
CS8B2	FINISH	123	1	BLACK	CS8B23	144
...	...	...	...	...	CS9BN1	145
CS8B8	FINISH	129	1	BLACK	CS9BN2	146
...	...	129	2	GALVANISED	...	...
CS8B23	FINISH	144	1	BLACK	CS9B1	152
CS9BN1	RATING	145	1	NOT APPLICABLE	CS9B1	152
CS9BN2		146	1	NOT APPLICABLE	...	...
CS9BN3		147	1	NOT APPLICABLE	CS9B12	167
CS9BN4		148	1	NOT APPLICABLE	CS10B1	168
CS9BN5		149	1	NOT APPLICABLE	CS10B2	169
CS9BN6		150	1	NOT APPLICABLE	CS10B3	170
CS9BN7		151	1	NOT APPLICABLE	CS10B4	171
CS9B1	RATING	152	1	2000#	CS10B5	172
...		152	2	3000#	CS10B6	173
CS9B12		152	3	6000#	CS10B7	174
...	...	...	...	...	CS10BN1	175
CS10B1	SCHEDULE	167	1	3000#	CS10BN1	175
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CS10B2		168	1	STANDARD WEIGHT	CS10BN17	195
...		168	2	EXTRA STRONG	CS10BN17	195
...	...	168	3	DOUBLE EXTRA STRONG	CS11K	196
...	...	168	4	SCHEDULE 10	CS11K	196
...	...	...	...	...	CS11L	197
CS10B2	SCHEDULE	168	13	SCHEDULE 160	CS11M	198
...		169	1	STANDARD WEIGHT	...	...
...		169	2	EXTRA STRONG	CS11Q	201
...		169	3	SCHEDULE 10	CS11R	202
...		169	4	SCHEDULE 20	CS11R	202
...		169	5	SCHEDULE 30	CS11R	202
CS10B3	SCHEDULE	169	6	SCHEDULE 40	CS11R	202
...		170	1	STANDARD WEIGHT	CS11S	203
CS10B4	SCHEDULE	170	2	EXTRA STRONG	CS11K	196
...		171	1	STANDARD WEIGHT	CS11K	196
CS10B5	SCHEDULE	171	2	EXTRA STRONG	CS11R	202
...		172	1	STANDARD WEIGHT	CS11R	202
...		172	2	EXTRA STRONG	CS11U	204
...	...	172	3	DOUBLE EXTRA STRONG	CS11U	204
...	...	...	...	...	CS11V	205
CS10B6	SCHEDULE	172	13	SCHEDULE 160	...	...
...		173	1	STANDARD WEIGHT	CS11Z	209
...		173	2	EXTRA STRONG	CS11AA	210
...		173	3	SCHEDULE 10	CS11AA	210
...		173	4	SCHEDULE 20	CS11AA	210
...		173	5	SCHEDULE 30	CS11AA	210
CS10B7	SCHEDULE	173	6	SCHEDULE 40	CS11AA	210
...		174	1	STANDARD WEIGHT	CS11AB	211
...		174	2	EXTRA STRONG	CS11AC	212
...	...	174	3	DOUBLE EXTRA STRONG	CS11AC	212
...	...	...	...	...	CS11AD	213
CS10BN1	...	174	13	SCHEDULE 160	...	...
CS10BN2	...	175	1	NOT APPLICABLE	CS11AH	217
...	...	176	1	NOT APPLICABLE	CS11AI	218
...	...	...	...	...	CS11AI	218

CS10BN10		184	1	NOT APPLICABLE	CS11AP	225
CS10BN11		185	1	NOT APPLICABLE	CS11AQ	226
CS10B8	SCHEDULE	186	1	SCHEDULE 80	CS11AM	222
		186	2	SCHEDULE 160	CS11AM	222
CS10B9	SCHEDULE	187	1	SCHEDULE 80	CS11AR	227
		187	2	SCHEDULE 160	CS11AS	228
CS10B10	SCHEDULE	188	1	STANDARD WEIGHT	CS11AT	229
		188	2	EXTRA STRONG	CS11AU	230
CS10B11	SCHEDULE	189	1	STANDARD WEIGHT	CS11AV	231
		189	2	EXTRA STRONG	CS11AV	231
CS10BN12		190	1	NOT APPLICABLE	CS11AW	232
CS10BN13		191	1	NOT APPLICABLE	CS11AX	233
CS10BN14		192	1	NOT APPLICABLE	CS11AW	232
CS10BN15		193	1	NOT APPLICABLE	CS11AY	234
CS10BN16		194	1	NOT APPLICABLE	CS11AV	231
CS10BN17		195	1	NOT APPLICABLE	CS11AZ	235
CS11K	SIZES	196	1	15		
		196	2	20		
		196	3	25		
...	...	...	...	...	...	...
		196	20	600		
CS11L	SIZES	197	1	15		
		197	2	20		
		197	3	25		
...	...	...	...	...	...	...
		197	15	300		
CS11M	SIZES	198	1	350		
		198	2	400		
		198	3	450		
		198	4	500		
		198	5	600		
CS11N	SIZES	199	1	200		
		199	2	250		
		199	3	300		
...	...	...	...	...	...	...
		199	8	600		
CS11P	SIZES	200	1	100		
		200	2	125		
		200	3	150		
...	...	...	...	...	...	...
		200	11	600		
CS11Q	SIZES	201	1	15		
		201	2	20		
		201	3	25		
...	...	...	...	...	...	...
		201	19	600		
CS11R	SIZES	202	1	750		
		202	2	900		
CS11S	SIZES	203	1	900		
CS11U	SIZES	204	1	20x15		
		204	2	25x20		
		204	3	25x15		
...	...	...	...	...	...	...
		204	80	600x250		
CS11V	SIZES	205	1	20x15		
		205	2	25x20		
		205	3	25x15		
...	...	...	...	...	...	...
		205	49	300x250		
CS11W	SIZES	206	1	400x350		
		206	2	450x400		
		206	3	450x350		
...	...	...	...	...	...	...
		206	10	600x350		
CS11X	SIZES	207	1	250x200		
		207	2	300x250		
		207	3	300x200		
...	...	...	...	...	...	...
		207	26	600x300		
		207	27	600x250		
CS11Y	SIZES	208	1	125x100		

		208	2	150x125		
		208	3	150x100		
...	...	...	...	...	...	...
		208	40	600x250		
CS11Z	SIZES	209	1	20x15		
		209	2	25x20		
		209	3	25x15		
...	...	...	...	...	...	...
		209	72	600x250		
CS11AA	SIZES	210	1	750x600		
		210	2	750x500		
		210	3	750x450		
...	...	...	...	...	...	...
		210	8	900x450		
CS11AB	SIZES	211	1	900x600		
		211	2	900x500		
		211	3	900x450		
...	...	...	...	...	...	...
CS11AZ	SIZES	235	1	15		
		235	2	20		
		235	3	25		
		235	4	32		
		235	5	40		
		235	6	50		
CS3C1	TYPE	236	1	STANDARD	CS4C1	237
		236	2	LARGE BORE	CS4C2	238
		236	3	ORIFICE	CS4C3	239
		236	4	BLINDS	CS4C4	240
CS4C1	DETAILS	237	1	SLIP ON	CS5C1	241
		237	2	SCREWED	CS5C1	241
		237	3	LAPPED	CS5C1	241
...	...	...	...	...	...	...
		237	10	SOCKET WELD	CS5C7	247
CS4C2	DETAILS	238	1	BLIND	CS5C8	248
		238	2	BLIND RING JOINT	CS5C9	249
		238	3	SLIP ON	CS5C10	250
		238	4	WELD NECK	CS5C11	251
		238	5	WELD NECK RING JOINT	CS5C12	252
CS4C3	DETAILS	239	1	SLIP ON	CS5C13	253
		239	2	SLIP ON RING JOINT	CS5C13	253
		239	3	WELD NECK	CS5C14	254
		239	4	WELD NECK RING JOINT	CS5C14	254
CS4C4	DETAILS	240	1	SPECTACLE BLIND	CS5C15	255
		240	2	PADDLE BLIND	CS5C16	256
		240	3	RING SPACER	CS5C16	256
CS5C1	STD.(DIM.)	241	1	ANSI B16.5	CS6C1	257
CS5C2	STD.(DIM.)	242	1	ANSI B16.5	CS6C2	258
CS5C3	STD.(DIM.)	243	1	ANSI B16.5	CS6C3	259
...	...	...	...	...	...	...
CS5C16	STD.(DIM.)	256	1	ANSI B16.5	CS6C18	274
CS6C1	STD.(MAT.)	257	1	ASTM A105	CS7CN1	275
		257	2	ASTM A350(LT)	CS7C1	276
CS6C2	STD.(MAT.)	258	1	ASTM A105	CS7CN2	277
		258	2	ASTM A350(LT)	CS7C2	278
...	...	...	...	...	...	...
CS6C18	STD.(MAT.)	274	1	ASTM A105	CS7CN18	308
CS7CN1	GRADES	275	1	NOT APPLICABLE	CS8C1	309
CS7C1		276	1	LF1	CS8C1	309
		276	2	LF2	CS8C1	309
		276	3	LF3	CS8C1	309
...	...	...	...	...	...	...
CS7CN18		308	1	NOT APPLICABLE	CS8C18	326
CS8C1	FINISH	309	1	BLACK	CS9C1	327
CS8C2	FINISH	310	1	BLACK	CS9C2	328
CS8C3	FINISH	311	1	BLACK	CS9C3	329
...	...	...	...	...	...	...
CS8C18	FINISH	326	1	BLACK	CS9C18	344
CS9C1	RATING	327	1	CLASS 150	CS10CN1	345
		327	2	CLASS 300	CS10CN1	345
		327	3	CLASS 600	CS10CN1	345
...	...	...	...	...	...	...
CS9C18	RATING	344	1	CLASS 150	CS10CN21	374



		344	2	CLASS 300	CS10CN21	374
		344	3	CLASS 600	CS10CN21	374
		344	4	CLASS 900	CS10CN21	374
CS10CN1		345	1	NOT APPLICABLE	CS11K	196
CS10CN2		346	1	NOT APPLICABLE	CS11Q	201
CS10CN3		347	1	NOT APPLICABLE	CS11BA	375
...	...	...	...	...	...	...
CS10CN14		358	1	NOT APPLICABLE	CS11BA	375
CS10C1	SCHEDULE	359	1	STANDARD WEIGHT	CS11K	196
		359	2	EXTRA STRONG	CS11K	196
		359	3	DOUBLE EXTRA STRONG	CS11L	197
		359	4	SCHEDULE 10	CS11M	198
...	...	...	...	...	...	...
CS10C2	SCHEDULE	359	13	SCHEDULE 160	CS11Q	201
		360	1	STANDARD WEIGHT	CS11BC	377
		360	2	EXTRA STRONG	CS11BC	377
		360	3	DOUBLE EXTRA STRONG	CS11BD	378
		360	4	SCHEDULE 10	CS11M	198
...	...	...	...	...	...	...
CS10C3	SCHEDULE	360	13	SCHEDULE 160	CS11BC	377
		361	1	STANDARD WEIGHT	CS11BA	375
		361	2	EXTRA STRONG	CS11BA	375
		361	3	DOUBLE EXTRA STRONG	CS11BA	375
		361	4	SCHEDULE 10	CS11M	198
...	...	...	...	...	...	...
CS10C4	SCHEDULE	361	13	SCHEDULE 160	CS11BA	375
		362	1	STANDARD WEIGHT	CS11BG	381
		362	2	EXTRA STRONG	CS11BG	381
		362	3	DOUBLE EXTRA STRONG	CS11BH	382
		362	4	SCHEDULE 10	CS11M	198
...	...	...	...	...	...	...
CS10C5	SCHEDULE	362	13	SCHEDULE 160	CS11BI	383
		363	1	STANDARD WEIGHT	CS11BJ	384
		363	2	EXTRA STRONG	CS11BJ	384
		363	3	DOUBLE EXTRA STRONG	CS11BJ	384
		363	4	SCHEDULE 40	CS11BJ	384
		363	5	SCHEDULE 80	CS11BJ	384
		363	6	SCHEDULE 160	CS11BJ	384
CS10C6	SCHEDULE	364	1	STANDARD WEIGHT	CS11BK	385
		364	2	EXTRA STRONG	CS11BK	385
		364	3	DOUBLE EXTRA STRONG	CS11BK	385
		364	4	SCHEDULE 40	CS11BK	385
		364	5	SCHEDULE 80	CS11BK	385
		364	6	SCHEDULE 160	CS11BK	385
CS10C7	SCHEDULE	365	1	STANDARD WEIGHT	CS11BL	386
		365	2	EXTRA STRONG	CS11BL	386
		365	3	DOUBLE EXTRA STRONG	CS11BL	386
		365	4	SCHEDULE 40	CS11BL	386
		365	5	SCHEDULE 80	CS11BL	386
		365	6	SCHEDULE 160	CS11BL	386
CS10CN15		366	1	NOT APPLICABLE	CS11BM	387
CS10CN16		367	1	NOT APPLICABLE	CS11BM	387
CS10CN17		368	1	NOT APPLICABLE	CS11BM	387
CS10C8	SCHEDULE	369	1	STANDARD WEIGHT	CS11BM	387
		369	2	EXTRA STRONG	CS11BM	387
		369	3	SCHEDULE 20	CS11BM	387
		369	4	SCHEDULE 30	CS11BN	388
		369	5	SCHEDULE 40	CS11BO	389
CS10CN18		370	1	NOT APPLICABLE	CS11BP	390
CS10C9	SCHEDULE	371	1	STANDARD WEIGHT	CS11BP	390
		371	2	EXTRA STRONG	CS11BP	390
		371	3	DOUBLE EXTRA STRONG	CS11BQ	391
		371	4	SCHEDULE 10	CS11M	198
...	...	...	...	...	...	...
CS10CN19		371	13	SCHEDULE 160	CS11BP	390
CS10CN20		372	1	NOT APPLICABLE	CS11BR	392
CS10CN21		373	1	NOT APPLICABLE	CS11BS	393
		374	1	NOT APPLICABLE	CS11BT	394
CS11BA	SIZES	375	1	15		
		375	2	20		
		375	3	25		
...	...	...	...	...	...	...
		375	14	300		



CS11BB	SIZES	376	1 25		
		376	2 32		
		376	3 40		
...	...	...	...	...	...
		376	18 600		
CS11BC	SIZES	377	1 15		
		377	2 20		
		377	3 25		
...	...	...	...	...	...
		377	19 600		
CS11BD	SIZES	378	1 15		
		378	2 20		
		378	3 25		
...	...	...	...	...	...
		378	14 300		
CS11BE	SIZES	379	1 200		
		379	2 250		
		379	3 300		
CS11BF	SIZES	380	1 100		
		380	2 150		
		380	3 200		
		380	4 250		
		380	5 300		
CS11BG	SIZES	381	1 25		
		381	2 32		
		381	3 40		
...	...	...	...	...	...
		381	18 600		
CS11BH	SIZES	382	1 25		
		382	2 32		
		382	3 40		
...	...	...	...	...	...
		382	13 300		
CS11BI		383	1 25		
		383	2 32		
		383	3 40		
...	...	...	...	...	...
		383	17 600		
CS11BJ	SIZES	384	1 25		
		384	2 32		
		384	3 40		
		384	4 50		
		384	5 65		
		384	6 80		
CS11BK	SIZES	385	1 15		
		385	2 20		
		385	3 25		
...	...	...	...	...	...
		385	8 80		
CS11BL	SIZES	386	1 15		
		386	2 20		
		386	3 25		
...	...	...	...	...	...
		386	7 65		
CS11BM	SIZES	387	1 650		
		387	2 700		
		387	3 750		
		387	4 800		
		387	5 850		
		387	6 900		
CS11BN	SIZES	388	1 700		
		388	2 750		
		388	3 800		
		388	4 850		
		388	5 900		
CS11BO	SIZES	389	1 800		
		389	2 850		
		389	3 900		
CS11BP	SIZES	390	1 25		
		390	2 32		
		390	3 40		
...	...	...	...	...	...

		390	17	600		
CS11BQ	SIZES	391	1	25		
		391	2	32		
		391	3	40		
...	...	...	...	...	...	...
		391	12	300		
CS11BR	SIZES	392	1	25		
		392	2	40		
		392	3	50		
...	...	...	...	...	...	...
		392	10	350		
CS11BS	SIZES	393	1	25		
		393	2	40		
		393	3	50		
...	...	...	...	...	...	...
		393	7	200		
CS11BT	SIZES	394	1	25		
		394	2	40		
		394	3	50		
...	...	...	...	...	...	...
		394	14	600		
CS3E1	TYPE	395	1	MACHINE BOLTS	CS4E1	396
		395	2	STUD BOLTS	CS4E2	397
CS4E1	DETAILS	396	1	Mc.BOLT SETS FOR FLGS. TO ANSI B16.5	CS5E1	398
		396	2	Mc.BOLT SETS FOR FLGS. TO BS3293	CS5E2	399
		396	3	Mc.BOLT SETS FOR FLGS. TO MSS-SP44	CS5E3	400
CS4E2	DETAILS	397	1	STUD BOLT SETS FOR FLGS. TO ANSI B16.5	CS5E4	401
		397	2	STUD BOLT SETS FOR FLGS. TO BS3293	CS5E5	402
		397	3	STUD BOLT SETS FOR FLGS. TO MSS-SP44	CS5E6	403
		397	4	STUD BOLT SETS (LT) FOR FLGS. TO ANSI B16.5	CS5E7	404
		397	5	STUD BOLT SETS (LT) FOR FLGS. TO BS3293	CS5E8	405
		397	6	STUD BOLT SETS (LT) FOR FLGS. TO MSS-SP44	CS5E9	406
		397	7	STUD BOLT SETS FOR FLGS. TO ANSI B16.36	CS5E10	407
		397	8	STUD BOLT SETS (LT) FOR FLGS. TO ANSI B16.36	CS5E11	408
CS5E1	STD. (DIM.)	398	1	ANSI B18.2	CS6E1	409
CS5E2	STD. (DIM.)	399	1	ANSI B18.2	CS6E2	410
CS5E3	STD. (DIM.)	400	1	ANSI B18.2	CS6E3	411
...	...	...	...	...	...	...
CS5E11	STD. (DIM.)	408	1	ANSI B18.2	CS6E11	419
CS6E1	STD. (MAT.)	409	1	ASTM A307	CS7E1	420
CS6E2	STD. (MAT.)	410	1	ASTM A307	CS7E2	421
CS6E3	STD. (MAT.)	411	1	ASTM A307	CS7E3	422
CS6E4	STD. (MAT.)	412	1	STUDS TO ASTM A193	CS7E4	423
		412	2	NUTS TO ASTM A194	CS7E5	424
CS6E5	STD. (MAT.)	413	1	STUDS TO ASTM A193	CS7E6	425
		413	2	NUTS TO ASTM A194	CS7E7	426
CS6E6	STD. (MAT.)	414	1	STUDS TO ASTM A193	CS7E8	427
		414	2	NUTS TO ASTM A194	CS7E9	428
CS6E7	STD. (MAT.)	415	1	STUDS TO ASTM A320	CS7E10	429
		415	2	NUTS TO ASTM A320	CS7E11	430
CS6E8	STD. (MAT.)	416	1	STUDS TO ASTM A320	CS7E12	431
		416	2	NUTS TO ASTM A320	CS7E13	432
CS6E9	STD. (MAT.)	417	1	STUDS TO ASTM A320	CS7E14	433
		417	2	NUTS TO ASTM A320	CS7E15	434
CS6E10	STD. (MAT.)	418	1	STUDS TO ASTM A193	CS7E16	435
		418	2	NUTS TO ASTM A194		436
CS6E11	STD. (MAT.)	419	1	STUDS TO ASTM A193		437
		419	2	NUTS TO ASTM A194		438
CS7E1	GRADES	420	1	NOT APPLICABLE	CS8E1	439
CS7E2	GRADES	421	1	NOT APPLICABLE	CS8E2	440
CS7E3	GRADES	422	1	NOT APPLICABLE	CS8E3	441
...	...	...	...	...	CS8E4	442
CS7E16	GRADES	438	1	2H	CS8E5	443
CS8E1	FINISH	439	1	BLACK	CS8E6	444
CS8E2	FINISH	440	1	BLACK	CS9E1	445
CS8E3	FINISH	441	1	BLACK	CS9E2	446
CS8E4	FINISH	442	1	BLACK	CS9E3	447
CS8E5	FINISH	443	1	BLACK	CS9E4	448
CS8E6	FINISH	444	1	BLACK	CS9E5	449
					CS9E6	450
						451

CS8E7	FINISH	445	1	BLACK	CS9E7	452
CS9E1	FLG. RATING	446	1	CLASS 150 RAISED FACE	CS10EN1	453
		446	2	CLASS 150 RING JOINT	CS10EN2	454
		446	3	CLASS 300 RAISED FACE	CS10EN3	455
		446	4	CLASS 300 RING JOINT	CS10EN4	456
CS9E2	FLG. RATING	447	1	CLASS 150 RAISED FACE	CS10EN5	457
		447	2	CLASS 300 RAISED FACE	CS10EN6	458
		447	3	CLASS 300 RING JOINT	CS10EN7	459
		447	4	CLASS 300 RING JOINT	CS10EN8	460
CS9E3	FLG. RATING	448	1	CLASS 150 RAISED FACE	CS10EN9	461
		448	2	CLASS 300 RAISED FACE	CS10EN10	462
		448	3	CLASS 300 RING JOINT	CS10EN11	463
		448	4	CLASS 300 RING JOINT	CS10EN12	464
CS9E4	FLG. RATING	449	1	CLASS 150 RAISED FACE	CS10EN13	465
		449	2	CLASS 150 RING JOINT		
		449	3	CLASS 300 RAISED FACE		
		449	4	CLASS 300 RING JOINT		
CS9E5	FLG. RATING	449	12	CLASS 2500 RING JOINT	CS10EN22	474
		450	1	CLASS 150 RAISED FACE	CS10EN23	475
		450	2	CLASS 300 RAISED FACE	CS10EN24	476
		450	3	CLASS 300 RING JOINT	CS10EN25	477
CS9E6	FLG. RATING	450	4	CLASS 600 RAISED FACE	CS10EN26	478
		450	5	CLASS 600 RING JOINT	CS10EN27	479
		451	1	CLASS 150 RAISED FACE	CS10EN28	480
		451	2	CLASS 300 RAISED FACE	CS10EN29	481
CS9E7	FLG. RATING	451	3	CLASS 300 RING JOINT	CS10EN30	482
		451	4	CLASS 600 RAISED FACE	CS10EN31	483
		451	5	CLASS 600 RING JOINT	CS10EN32	484
		451	6	CLASS 900 RAISED FACE	CS10EN33	485
CS10EN1		452	1	CLASS 300 RAISED FACE	CS10EN34	486
		452	2	CLASS 300 RING JOINT	CS10EN35	487
		452	3	CLASS 600 RAISED FACE	CS10EN36	488
		452	4	CLASS 600 RING JOINT	CS10EN37	489
CS10EN2		453	1	NOT APPLICABLE	CS11BU	490
CS10EN3		454	1	NOT APPLICABLE	CS11BV	491
...	...	455	1	NOT APPLICABLE	CS11BW	492
CS10EN37		489	1	NOT APPLICABLE	CS11DE	526
CS11BU	FLG. SIZES	490	1	15	CS12BU1	
		490	2	20	CS12BU2	
		490	3	25	CS12BU3	
CS11BV	FLG. SIZES	490	20	600	CS12BU20	
		491	1	25	CS12BV1	
		491	2	32	CS12BV2	
CS11BW	FLG. SIZES	491	3	40	CS12BV3	
		491	18	600	CS12BV18	
		492	1	15	CS12BW1	
CS11BX	FLG. SIZES	492	2	20	CS12BW2	
		492	3	25	CS12BW3	
		492	20	600	CS12BW20	
CS11BY	FLG. SIZES	493	1	15	CS12BX1	
		493	2	20	CS12BX2	
		493	3	25	CS12BX3	
CS11BZ	FLG. SIZES	493	20	600	CS12BX20	
		494	1	650	CS12BY1	
		494	2	700	CS12BY2	
CS11CA	FLG. SIZES	494	3	750	CS12BY3	
		494	4	800	CS12BY4	
		494	5	850	CS12BY5	
CS11CB	FLG. SIZES	494	6	900	CS12BY6	
		495	1	650	CS12BZ1	
		495	2	700	CS12BZ2	
CS11CC	FLG. SIZES	495	3	750	CS12BZ3	
		495	4	800	CS12BZ4	
		495	5	850	CS12BZ5	
CS11CD	FLG. SIZES	495	6	900	CS12BZ6	
		496	1	650	CS12CA1	
		496	2	700	CS12CA2	
CS11CE	FLG. SIZES	496	3	750	CS12CA3	
		496	4	800	CS12CA4	
		496	6	900		

CS11CB	FLG. SIZES	496	5 850
		496	6 900
		497	1 650
		497	2 700
		497	3 750
CS11CC	FLG. SIZES	497	4 800
		497	5 850
		497	6 900
		498	1 650
		498	2 700
CS11CD	FLG. SIZES	498	3 750
		498	4 800
		498	5 850
		498	6 900
		499	1 650
CS11CE	FLG. SIZES	499	2 700
		499	3 750
		499	4 800
		499	5 850
		499	6 900
...	...	500	1 15
		500	2 20
		500	3 25
		...	...
CS11CF	FLG. SIZES	500	20 600
		501	1 25
		501	2 32
		501	3 40
...	...	...	...
		501	18 600
		502	1 15
		502	2 20
CS11CG	FLG. SIZES	502	3 25
		...	...
		502	20 600
		503	1 15
...	...	503	2 20
		503	3 25
		...	...
		503	20 600
CS11CI	FLG. SIZES	504	1 15
		504	2 20
		504	3 25
		...	...
...	...	504	20 600
		505	1 15
		505	2 20
		505	3 25
...	...	...	...
		505	20 600
		506	1 15
		506	2 20
CS11CK	FLG. SIZES	506	3 25
		...	...
		506	19 600
		507	1 15
...	...	507	2 20
		507	3 25
		...	...
		507	19 600
CS11CL	FLG. SIZES	508	1 15
		508	2 20
		508	3 25
		...	...
...	...	508	19 600
		509	1 15
		509	2 20
		509	3 25
...	...	...	...
		509	19 600
		510	1 15
		510	2 20
CS11CO	FLG. SIZES	510	3 25
		...	...
		...	...

CS12CA5	
CS12CA6	
CS12CB1	
CS12CB2	
CS12CB3	
CS12CB4	
CS12CB5	
CS12CB6	
CS12CC1	
CS12CC2	
CS12CC3	
CS12CC4	
CS12CC5	
CS12CC6	
CS12CD1	
CS12CD2	
CS12CD3	
CS12CD4	
CS12CD5	
CS12CD6	
CS12CE1	
CS12CE2	
CS12CE3	
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CS12CE20	
CS12CF1	
CS12CF2	
CS12CF3	
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CS12CF18	
CS12CG1	
CS12CG2	
CS12CG3	
...	...
CS12CG20	
CS12CH1	
CS12CH2	
CS12CH3	
...	...
CS12CH20	
CS12CI1	
CS12CI2	
CS12CI3	
...	...
CS12CI20	
CS12CJ1	
CS12CJ2	
CS12CJ3	
...	...
CS12CJ20	
CS12CK1	
CS12CK2	
CS12CK3	
...	...
CS12CK19	
CS12CL1	
CS12CL2	
CS12CL3	
...	...
CS12CL19	
CS12CM1	
CS12CM2	
CS12CM3	
...	...
CS12CM19	
CS12CN1	
CS12CN2	
CS12CN3	
...	...
CS12CN19	
CS12CO1	
CS12CO2	
CS12CO3	

...	...	...	...	...
CS11CP	FLG. SIZES	510	14	300
		511	1	15
		511	2	20
		511	3	25
...	...	...	...	...
CS11CQ	FLG. SIZES	511	14	300
		512	1	650
		512	2	700
		512	3	750
		512	4	800
		512	5	850
		512	6	900
CS11CR	FLG. SIZES	513	1	650
		513	2	700
		513	3	750
		513	4	800
		513	5	850
		513	6	900
CS11CS	FLG. SIZES	514	1	650
		514	2	700
		514	3	750
		514	4	800
		514	5	850
		514	6	900
CS11CT	FLG. SIZES	515	1	650
		515	2	700
		515	3	750
		515	4	800
		515	5	850
		515	6	900
CS11CU	FLG. SIZES	516	1	650
		516	2	700
		516	3	750
		516	4	800
		516	5	850
		516	6	900
CS11CV	FLG. SIZES	517	1	650
		517	2	700
		517	3	750
		517	4	800
		517	5	850
		517	6	900
CS11CW	FLG. SIZES	518	1	650
		518	2	700
		518	3	750
		518	4	800
		518	5	850
		518	6	900
CS11CX	FLG. SIZES	519	1	650
		519	2	700
		519	3	750
		519	4	800
		519	5	850
		519	6	900
CS11CY	FLG. SIZES	520	1	650
		520	2	700
		520	3	750
		520	4	800
		520	5	850
		520	6	900
CS11CZ	FLG. SIZES	521	1	650
		521	2	700
		521	3	750
		521	4	800
		521	5	850
		521	6	900
CS11DA	FLG. SIZES	522	1	650
		522	2	700
		522	3	750
		522	4	800
		522	5	850
		522	6	900

...	...	...
CS12CO14		
CS12CP1		
CS12CP2		
CS12CP3		
...	...	...
CS12CP14		
CS12CQ1		
CS12CQ2		
CS12CQ3		
CS12CQ4		
CS12CQ5		
CS12CQ6		
CS12CR1		
CS12CR2		
CS12CR3		
CS12CR4		
CS12CR5		
CS12CR6		
CS12CS1		
CS12CS2		
CS12CS3		
CS12CS4		
CS12CS5		
CS12CS6		
CS12CT1		
CS12CT2		
CS12CT3		
CS12CT4		
CS12CT5		
CS12CT6		
CS12CU1		
CS12CU2		
CS12CU3		
CS12CU4		
CS12CU5		
CS12CU6		
CS12CV1		
CS12CV2		
CS12CV3		
CS12CV4		
CS12CV5		
CS12CV6		
CS12CW1		
CS12CW2		
CS12CW3		
CS12CW4		
CS12CW5		
CS12CW6		
CS12CX1		
CS12CX2		
CS12CX3		
CS12CX4		
CS12CX5		
CS12CX6		
CS12CY1		
CS12CY2		
CS12CY3		
CS12CY4		
CS12CY5		
CS12CY6		
CS12CZ1		
CS12CZ2		
CS12CZ3		
CS12CZ4		
CS12CZ5		
CS12CZ6		
CS12DA1		
CS12DA2		
CS12DA3		
CS12DA4		
CS12DA5		
CS12DA6		

CS11DB	FLG. SIZES	523	1	25	CS12DB1		
		523	2	32	CS12DB2		
		523	3	40	CS12DB3		
...	...	...	...	...	...	...	
CS11DC	FLG. SIZES	523	17	600	CS12DB17		
		524	1	25	CS12DC1		
		524	2	32	CS12DC2		
		524	3	40	CS12DC3		
		524	4	50	CS12DC4		
...	...	...	...	...	...	...	
CS11DD	FLG. SIZES	524	16	500	CS12DC16		
		524	17	600	CS12DC17		
		525	1	25	CS12DD1		
		525	2	32	CS12DD2		
		525	3	40	CS12DD3		
		525	4	50	CS12DD4		
...	...	...	...	...	...	...	
CS11DE	FLG. SIZES	525	16	500	CS12DD16		
		525	17	600	CS12DD17		
		526	1	25	CS12DE1		
		526	2	32	CS12DE2		
		526	3	40	CS12DE3		
		526	4	50	CS12DE4		
...	...	...	...	...	...	...	
		526	16	500	CS12DE16		
		526	17	600	CS12DE17		
CS12BU1	BOLT SIZES		1	1/2 DIA.x 45 mm LG			
CS12BU2			2	1/2 DIA.x 50 mm LG			
CS12BU3			3	1/2 DIA.x 55 mm LG			
CS12BU4			4	1/2 DIA.x 55 mm LG			
...	...	...	...	...	...	...	
CS12BU19			19	1-1/8 DIA.x 135 mm LG			
CS12BU20			20	1-1/4 DIA.x 145 mm LG			
CS12BV1	BOLT SIZES		1	1/2 DIA.x 70 mm LG			
CS12BV2			2	1/2 DIA.x 70 mm LG			
CS12BV3			3	1/2 DIA.x 75 mm LG			
CS12BV4			4	5/8 DIA.x 80 mm LG			
...	...	...	...	...	...	...	
CS12BV17			17	1-1/8 DIA.x 150 mm LG			
CS12BV18			18	1-1/4 DIA.x 160 mm LG			
CS12BW1	BOLT SIZES		1	1/2 DIA.x 55 mm LG			
CS12BW2			2	5/8 DIA.x 60 mm LG			
CS12BW3			3	5/8 DIA.x 65 mm LG			
CS12BW4			4	5/8 DIA.x 65 mm LG			
...	...	...	...	...	...	...	
CS12BW19			19	1-1/4 DIA.x 180 mm LG			
CS12BW20			20	1-1/2 DIA.x 195 mm LG			
CS12BX1	BOLT SIZES		1	1/2 DIA.x 70 mm LG			
CS12BX2			2	5/8 DIA.x 75 mm LG			
CS12BX3			3	5/8 DIA.x 80 mm LG			
CS12BX4			4	5/8 DIA.x 80 mm LG			
...	...	...	...	...	...	...	
CS12BX19			19	1-1/4 DIA.x 205 mm LG			
CS12BX20			20	1-1/2 DIA.x 220 mm LG			
CS12BY1	BOLT SIZES		1	1-1/4 DIA.x 145 mm LG			
CS12BY2			2	1-1/4 DIA.x 150 mm LG			
CS12BY3			3	1-1/4 DIA.x 160 mm LG			
CS12BY4			4	1-1/2 DIA.x 165 mm LG			
CS12BY5			5	1-1/2 DIA.x 170 mm LG			
CS12BY6			6	1-1/2 DIA.x 180 mm LG			
CS12BZ1	BOLT SIZES		1	1-5/8 DIA.x 210 mm LG			
CS12BZ2			2	1-5/8 DIA.x 225 mm LG			
CS12BZ3			3	1-3/4 DIA.x 250 mm LG			
CS12BZ4			4	1-7/8 DIA.x 255 mm LG			
CS12BZ5			5	1-7/8 DIA.x 260 mm LG			
CS12BZ6			6	2 DIA.x 280 mm LG			
CS12CA1	BOLT SIZES		1	1-5/8 DIA.x 240 mm LG			
CS12CA2			2	1-5/8 DIA.x 255 mm LG			
CS12CA3			3	1-3/4 DIA.x 280 mm LG			
CS12CA4			4	1-7/8 DIA.x 290 mm LG			

CS12CA5			5	1-7/8 DIA.x 295 mm LG		
CS12CA6			6	2 DIA.x 315 mm LG		
CS12CB1	BOLT SIZES		1	1-1/4 DIA.x 180 mm LG		
CS12CB2			2	1-1/4 DIA.x 185 mm LG		
CS12CB3			3	1-1/4 DIA.x 195 mm LG		
CS12CB4			4	1-1/2 DIA.x 210 mm LG		
CS12CB5			5	1-1/2 DIA.x 215 mm LG		
CS12CB6			6	1-1/2 DIA.x 230 mm LG		
CS12CC1	BOLT SIZES		1	1-5/8 DIA.x 210 mm LG		
CS12CC2			2	1-5/8 DIA.x 225 mm LG		
CS12CC3			3	1-3/4 DIA.x 250 mm LG		
CS12CC4			4	1-7/8 DIA.x 255 mm LG		
CS12CC5			5	1-7/8 DIA.x 260 mm LG		
CS12CC6			6	2 DIA.x 280 mm LG		
CS12CD1	BOLT SIZES		1	1-5/8 DIA.x 240 mm LG		
CS12CD2			2	1-5/8 DIA.x 255 mm LG		
CS12CD3			3	1-3/4 DIA.x 280 mm LG		
CS12CD4			4	1-7/8 DIA.x 290 mm LG		
CS12CD5			5	1-7/8 DIA.x 295 mm LG		
CS12CD6			6	2 DIA.x 315 mm LG		
CS12CE1	BOLT SIZES		1	1/2 DIA.x 60 mm LG		
CS12CE2			2	1/2 DIA.x 65 mm LG		
CS12CE3			3	1/2 DIA.x 65 mm LG		
CS12CE4			4	1/2 DIA.x 70 mm LG		
...	...	...	...	...	...	...
CS12CE19			19	1-1/8 DIA.x 160 mm LG		
CS12CE20			20	1-1/4 DIA.x 170 mm LG		
CS12CF1	BOLT SIZES		1	1/2 DIA.x 80 mm LG		
CS12CF2			2	1/2 DIA.x 85 mm LG		
CS12CF3			3	1/2 DIA.x 85 mm LG		
CS12CF4			4	5/8 DIA.x 100 mm LG		
...	...	...	...	...	...	...
CS12CF17			17	1-1/8 DIA.x 175 mm LG		
CS12CF18			18	1-1/4 DIA.x 185 mm LG		
CS12CG1	BOLT SIZES		1	1/2 DIA.x 65 mm LG		
CS12CG2			2	5/8 DIA.x 75 mm LG		
CS12CG3			3	5/8 DIA.x 75 mm LG		
CS12CG4			4	5/8 DIA.x 85 mm LG		
...	...	...	...	...	...	...
CS12CG19			19	1-1/4 DIA.x 205 mm LG		
CS12CG20			20	1-1/2 DIA.x 230 mm LG		
CS12CH1	BOLT SIZES		1	1/2 DIA.x 80 mm LG		
CS12CH2			2	5/8 DIA.x 90 mm LG		
CS12CH3			3	5/8 DIA.x 90 mm LG		
CS12CH4			4	5/8 DIA.x 100 mm LG		
...	...	...	...	...	...	...
CS12CH19			19	1-1/4 DIA.x 230 mm LG		
CS12CH20			20	1-1/2 DIA.x 255 mm LG		
CS12CI1	BOLT SIZES		1	1/2 DIA.x 75 mm LG		
CS12CI2			2	5/8 DIA.x 90 mm LG		
CS12CI3			3	5/8 DIA.x 90 mm LG		
CS12CI4			4	5/8 DIA.x 95 mm LG		
...	...	...	...	...	...	...
CS12CI19			19	1-5/8 DIA.x 285 mm LG		
CS12CI20			20	1-7/8 DIA.x 330 mm LG		
CS12CJ1	BOLT SIZES		1	1/2 DIA.x 80 mm LG		
CS12CJ2			2	5/8 DIA.x 95 mm LG		
CS12CJ3			3	5/8 DIA.x 95 mm LG		
CS12CJ4			4	5/8 DIA.x 100 mm LG		
...	...	...	...	...	...	...
CS12CJ19			19	1-5/8 DIA.x 300 mm LG		
CS12CJ20			20	1-7/8 DIA.x 345 mm LG		
CS12CK1	BOLT SIZES		1	3/4 DIA.x 110 mm LG		
CS12CK2			2	3/4 DIA.x 115 mm LG		
CS12CK3			3	7/8 DIA.x 130 mm LG		
CS12CK4			4	7/8 DIA.x 130 mm LG		
...	...	...	...	...	...	...
CS12CK18			18	1-7/8 DIA.x 350 mm LG		

CS12CK19			19	2-1/2 DIA.x 440 mm LG			
CS12CL1	BOLT SIZES		1	3/4 DIA.x 115 mm LG			
CS12CL2			2	3/4 DIA.x 120 mm LG			
CS12CL3			3	7/8 DIA.x 135 mm LG			
CS12CL4			4	7/8 DIA.x 135 mm LG			
...	...	...	...	...	...	...	...
CS12CL18			18	1-7/8 DIA.x 370 mm LG			
CS12CL19			19	2-1/2 DIA.x 470 mm LG			
CS12CM1	BOLT SIZES		1	3/4 DIA.x 110 mm LG			
CS12CM2			2	3/4 DIA.x 115 mm LG			
CS12CM3			3	7/8 DIA.x 130 mm LG			
CS12CM4			4	7/8 DIA.x 130 mm LG			
...	...	...	...	...	...	...	...
CS12CM18			18	3 DIA.x 540 mm LG			
CS12CM19			19	3-1/2 DIA.x 615 mm LG			
CS12CN1	BOLT SIZES		1	3/4 DIA.x 115 mm LG			
CS12CN2			2	3/4 DIA.x 120 mm LG			
CS12CN3			3	7/8 DIA.x 135 mm LG			
CS12CN4			4	7/8 DIA.x 135 mm LG			
...	...	...	...	...	...	...	...
CS12CN18			18	3 DIA.x 575 mm LG			
CS12CN19			19	3-1/2 DIA.x 660 mm LG			
CS12CO1	BOLT SIZES		1	3/4 DIA.x 120 mm LG			
CS12CO2			2	3/4 DIA.x 130 mm LG			
CS12CO3			3	7/8 DIA.x 140 mm LG			
CS12CO4			4	1 DIA.x 155 mm LG			
...	...	...	...	...	...	...	...
CS12CO13			13	2-1/2 DIA.x 490 mm LG			
CS12CO14			14	2-3/4 DIA.x 540 mm LG			
CS12CP1	BOLT SIZES		1	3/4 DIA.x 125 mm LG			
CS12CP2			2	3/4 DIA.x 135 mm LG			
CS12CP3			3	7/8 DIA.x 145 mm LG			
CS12CP4			4	1 DIA.x 165 mm LG			
...	...	...	...	...	...	...	...
CS12CP13			13	2-1/2 DIA.x 525 mm LG			
CS12CP14			14	2-3/4 DIA.x 575 mm LG			
CS12CQ1	BOLT SIZES		1	1-1/4 DIA.x 170 mm LG			
CS12CQ2			2	1-1/4 DIA.x 180 mm LG			
CS12CQ3			3	1-1/4 DIA.x 180 mm LG			
CS12CQ4			4	1-1/2 DIA.x 200 mm LG			
CS12CQ5			5	1-1/2 DIA.x 205 mm LG			
CS12CQ6			6	1-1/2 DIA.x 205 mm LG			
CS12CR1	BOLT SIZES		1	1-5/8 DIA.x 250 mm LG			
CS12CR2			2	1-5/8 DIA.x 260 mm LG			
CS12CR3			3	1-3/4 DIA.x 280 mm LG			
CS12CR4			4	1-7/8 DIA.x 300 mm LG			
CS12CR5			5	1-7/8 DIA.x 305 mm LG			
CS12CR6			6	2 DIA.x 320 mm LG			
CS12CS1			1	1-5/8 DIA.x 280 mm LG			
CS12CS2			2	1-5/8 DIA.x 290 mm LG			
CS12CS3			3	1-3/4 DIA.x 310 mm LG			
CS12CS4			4	1-7/8 DIA.x 335 mm LG			
CS12CS5			5	1-7/8 DIA.x 340 mm LG			
CS12CS6			6	2 DIA.x 355 mm LG			
CS12CT1	BOLT SIZES		1	1-7/8 DIA.x 330 mm LG			
CS12CT2			2	2 DIA.x 345 mm LG			
CS12CT3			3	2 DIA.x 350 mm LG			
CS12CT4			4	2-1/4 DIA.x 370 mm LG			
CS12CT5			5	2-1/4 DIA.x 375 mm LG			
CS12CT6			6	2-1/2 DIA.x 395 mm LG			
CS12CU1	BOLT SIZES		1	1-7/8 DIA.x 350 mm LG			
CS12CU2			2	2 DIA.x 365 mm LG			
CS12CU3			3	2 DIA.x 370 mm LG			
CS12CU4			4	2-1/4 DIA.x 395 mm LG			
CS12CU5			5	2-1/4 DIA.x 400 mm LG			
CS12CU6			6	2-1/2 DIA.x 420 mm LG			
CS12CV1	BOLT SIZES		1	1-1/4 DIA.x 205 mm LG			
CS12CV2			2	1-1/4 DIA.x 220 mm LG			



CS12CV3			3	1-1/4 DIA.x 225 mm LG		
CS12CV4			4	1-1/2 DIA.x 250 mm LG		
CS12CV5			5	1-1/2 DIA.x 255 mm LG		
CS12CV6			6	1-1/2 DIA.x 265 mm LG		
CS12CW1	BOLT SIZES		1	1-5/8 DIA.x 250 mm LG		
CS12CW2			2	1-5/8 DIA.x 260 mm LG		
CS12CW3			3	1-3/4 DIA.x 280 mm LG		
CS12CW4			4	1-7/8 DIA.x 300 mm LG		
CS12CW5			5	1-7/8 DIA.x 305 mm LG		
CS12CW6			6	2 DIA.x 320 mm LG		
CS12CX1	BOLT SIZES		1	1-5/8 DIA.x 280 mm LG		
CS12CX2			2	1-5/8 DIA.x 290 mm LG		
CS12CX3			3	1-3/4 DIA.x 310 mm LG		
CS12CX4			4	1-7/8 DIA.x 335 mm LG		
CS12CX5			5	1-7/8 DIA.x 340 mm LG		
CS12CX6			6	2 DIA.x 355 mm LG		
CS12CY1	BOLT SIZES		1	1-7/8 DIA.x 330 mm LG		
CS12CY2			2	2 DIA.x 345 mm LG		
CS12CY3			3	2 DIA.x 350 mm LG		
CS12CY4			4	2-1/4 DIA.x 370 mm LG		
CS12CY5			5	2-1/4 DIA.x 375 mm LG		
CS12CY6			6	2-1/2 DIA.x 395 mm LG		
CS12CZ1	BOLT SIZES		1	1-7/8 DIA.x 350 mm LG		
CS12CZ2			2	2 DIA.x 365 mm LG		
CS12CZ3			3	2 DIA.x 370 mm LG		
CS12CZ4			4	2-1/4 DIA.x 395 mm LG		
CS12CZ5			5	2-1/4 DIA.x 400 mm LG		
CS12CZ6			6	2-1/2 DIA.x 420 mm LG		
CS12DA1	BOLT SIZES		1	2-3/4 DIA.x 450 mm LG		
CS12DA2			2	3 DIA.x 470 mm LG		
CS12DA3			3	3 DIA.x 480 mm LG		
CS12DA4			4	3-1/4 DIA.x 500 mm LG		
CS12DA5			5	3-1/2 DIA.x 525 mm LG		
CS12DA6			6	3-1/2 DIA.x 540 mm LG		
CS12DB1	BOLT SIZES		1	5/8 DIA.x 130 mm LG		
CS12DB2			2	5/8 DIA.x 130 mm LG		
CS12DB3			3	3/4 DIA.x 135 mm LG		
CS12DB4			4	5/8 DIA.x 130 mm LG		
...	...	...	...	...	...	...
CS12DB16			16	1-1/4 DIA.x 215 mm LG		
CS12DB17			17	1-1/2 DIA.x 245 mm LG		
CS12DC1	BOLT SIZES		1	5/8 DIA.x 145 mm LG		
CS12DC2			2	5/8 DIA.x 145 mm LG		
CS12DC3			3	3/4 DIA.x 150 mm LG		
CS12DC4			4	5/8 DIA.x 150 mm LG		
...	...	...	...	...	...	...
CS12DC16			16	1-1/4 DIA.x 240 mm LG		
CS12DC17			17	1-1/2 DIA.x 270 mm LG		
CS12DD1	BOLT SIZES		1	5/8 DIA.x 130 mm LG		
CS12DD2			2	5/8 DIA.x 130 mm LG		
CS12DD3			3	3/4 DIA.x 135 mm LG		
CS12DD4			4	5/8 DIA.x 130 mm LG		
...	...	...	...	...	...	...
CS12DD16			16	1-5/8 DIA.x 300 mm LG		
CS12DD17			17	1-7/8 DIA.x 340 mm LG		
CS12DE1	BOLT SIZES		1	5/8 DIA.x 135 mm LG		
CS12DE2			2	5/8 DIA.x 135 mm LG		
CS12DE3			3	3/4 DIA.x 140 mm LG		
CS12DE4			4	5/8 DIA.x 140 mm LG		
...	...	...	...	...	...	...
CS12DE16			16	1-5/8 DIA.x 315 mm LG		
CS12DE17			17	1-7/8 DIA.x 355 mm LG		
CS3F1	TYPE	527	1	COMPRESSED FIBRE	CS4F1	528
		527	2	SPIRAL WOUND	CS4F2	529
		527	3	METAL RING JOINT	CS4F3	530
		527	4	INSULATING SETS	CS4F4	531
CS4F1	DETAILS	528	1	KLINGER SIL C4210 FULL FACE	CS5FN1	532
		528	2	KLINGER SIL C4400 FULL FACE	CS5FN1	532

...	...	528	3	KLINGER SIL C4430 FULL FACE	CS5FN1	532
		528	4	KLINGER SIL C4500 FULL FACE	CS5FN1	532
		...	...	...	...	...
		528	11	KLINGER SIL C6327 RING JOINT	CS5FN1	532
CS4F2	DETAILS	528	12	KLINGER SIL C8200 RING JOINT	CS5FN1	532
		529	1	TYPE CR & CRIR FOR FLGS. TO ANSI B16.5	CS5FN2	
		529	2	TYPE CR & CRIR FOR FLGS. TO MSS-SP44	CS5FN3	
		529	3	TYPE CR & CRIR FOR FLGS. TO BS3293	CS5FN4	535
CS4F3	DETAILS	530	1	RTJ TYPE R (OVAL) FOR FLGS. TO 600 DIA.	CS5FN5	
		530	2	RTJ TYPE R (OCTAGONAL) FLGS. TO 600 DIA.	CS5FN5	
		530	3	RTJ TYPE R (OVAL) FLGS. ABOVE 600 DIA.	CS5FN6	
		530	4	RTJ TYPE R (OCTAGONAL) FLGS. ABOVE 600 DIA.	CS5FN6	
CS4F4	DETAILS	531	1	TYPE E FULL FACE	CS5FN7	538
		531	2	TYPE F RAISED FACE	CS5FN7	538
		531	3	TYPE D RING GROOVE	CS5FN7	538
CS5FN1		532	1	NOT APPLICABLE	CS6FN1	539
CS5FN2		533	1	NOT APPLICABLE	CS6FN2	540
CS5FN3		534	1	NOT APPLICABLE	CS6FN3	541
CS5FN4		535	1	NOT APPLICABLE	CS6FN4	542
CS5FN5		536	1	NOT APPLICABLE	CS6FN5	543
CS5FN6		537	1	NOT APPLICABLE	CS6FN6	544
CS5FN7		538	1	NOT APPLICABLE	CS6FN7	545
CS6FN1		539	1	NOT APPLICABLE	CS7FN1	546
CS6FN2		540	1	NOT APPLICABLE	CS7FN2	547
CS6FN3		541	1	NOT APPLICABLE	CS7FN3	548
CS6FN4		542	1	NOT APPLICABLE	CS7FN4	549
CS6FN5		543	1	NOT APPLICABLE	CS7FN5	550
CS6FN6		544	1	NOT APPLICABLE	CS7FN6	551
CS6FN7		545	1	NOT APPLICABLE	CS7FN7	552
CS7FN1		546	1	NOT APPLICABLE	CS8FN1	553
CS7FN2		547	1	NOT APPLICABLE	CS8FN2	554
CS7FN3		548	1	NOT APPLICABLE	CS8FN3	555
CS7FN4		549	1	NOT APPLICABLE	CS8FN4	556
CS7FN5		550	1	NOT APPLICABLE	CS8FN5	557
CS7FN6		551	1	NOT APPLICABLE	CS8FN6	558
CS7FN7		552	1	NOT APPLICABLE	CS8FN7	559
CS8FN1		553	1	NOT APPLICABLE	CS9F1	560
CS8FN2		554	1	NOT APPLICABLE	CS9F2	561
CS8FN3		555	1	NOT APPLICABLE	CS9F3	562
CS8FN4		556	1	NOT APPLICABLE	CS9F4	563
CS8FN5		557	1	NOT APPLICABLE	CS9F5	564
CS8FN6		558	1	NOT APPLICABLE	CS9F6	565
CS8FN7		559	1	NOT APPLICABLE	CS9F7	566
CS9F1	RATING	560	1	CLASS 150	CS10FN1	567
		560	2	CLASS 300	CS10FN1	567
		560	3	CLASS 600	CS10FN1	567
		560	4	CLASS 900	CS10FN1	567
CS9F7	RATING	566	1	CLASS 150	CS10FN1	567
		566	2	CLASS 300	CS10FN1	567
		566	3	CLASS 600	CS10FN1	567
		566	4	CLASS 900	CS10FN1	567
		566	5	CLASS 1500	CS10FN3	569
		566	6	CLASS 2500	CS10FN4	570
CS10FN1		567	1	NOT APPLICABLE	CS11DF	572
CS10FN2		568	1	NOT APPLICABLE	CS11K	196
CS10FN3		569	1	NOT APPLICABLE	CS11Q	201
CS10FN4		570	1	NOT APPLICABLE	CS11BA	375
CS10FN5		571	1	NOT APPLICABLE	CS11BM	387
CS11DF	SIZES	572	1	15		
		572	2	20		
		572	3	30		
		572	4	40		
...	...	...	...	...	...	...
		572	24	850		
		572	25	900		

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If a user selects item number 2 (Fittings) from the component menu M2, the user is then presented with type menu CS3B1 from which they are required to select one of four items. Depending upon which of the four items the user selects, they are then presented with details menu CS4B1, CS4B2, CS4B3 or CS4B4, and so forth. When a user has selected an item from the Size menu, the selection process for that material is complete.

In order to simplify the selection process, where a menu contains only one menu item, such as menu CS5A1, the selection of the single item is made automatically and the next menu is presented to the user.

10 The items selected in each of the menus are passed to the output means 36.

Whilst the selections made by the user from the menus are sufficient to uniquely identify the material, the number of man-hours required to install the material is predominantly dependent upon the volume and weight of the material, which has not been selected in the menus. However, for each material, the weight and volume are constant and are stored as data in the reference database 10.

The indexing means 30 forms an index for the material based upon the selection made in each of the component menu M2, detail menu, the rating menu, the schedule menu and the size menu. In this manner, a unique index is formed by simple concatenation of the menu number, e.g. M2, CS4B1 etc and the menu item that is selected from within that menu.

The index is output to the reference means 32 which utilises the index in referencing the reference database 10. The reference database 10 includes weight data, volume data, other data (to be described below) and also includes control data. The data referenced in the reference database 10 are passed to the processing means 34.

The processing means 34 receives the data and depending upon the instruction contained in the control data, processes the data in one of the several ways.

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One of the instructions that the control data can include is that the other data in the reference database 10 represents the man-hours required to install the material. This is useful if, because of the nature of the material, the man-hours required to install the material is largely independent of factors such as the  
5 height to which the material is to be installed. The processing means 34 responds to this instruction by simply passing the data from the reference database 10, including the man-hours, onto the output means 36.

Alternatively, the control data can include an instruction that the other data in the reference database 10 represents a further index to a formula used to  
10 calculate the man-hours required to install the material. In the event of such an instruction, the processing means 34 references the formula from a formulae database 42 using the further index.

In addition, the processing means 34 references a formula adjustment database 44 using the further index. The formula adjustment database 44 contains an  
15 adjustment of the formula contained in the formula database 42, which adjustment is provided to make the calculation of the man-hours more accurate based upon past discrepancies between estimates of man-hours and actual man-hour values. Whether or not the processing means 34 references the formula adjustment table 44 is an option selectable by the user.

20 The processing means 34 calculates, from the formula, the data from the reference database 10 and from any formula adjustment, the man-hours required to install the material and outputs the same and the data from the reference database to the output means 36. The formula for installing different types of materials varies, in terms of whether the relationship between weight,  
25 volume and man-hours is linear, exponential or logarithmic and also in terms of whether any constants, such as the slope of the linear relationship, changes. In the case of one type of material, the man-hours required to install a material is dependent predominantly upon volume; in another case it is dependent entirely

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upon volume; in a further case it is dependent entirely upon weight; and in a further case still, it is dependent on a combination of both.

Once the man-hours have been calculated, the processing means 34 outputs the data from the reference database 10 and the man-hours to the output means  
5 36.

The output means 36 receives the selections made by the user from the interface means 28 and the data and the man-hours from the processing means 34 and formats these into a format suitable for the direct cost estimating module 14. In the embodiment, the selections, the data and the man-hours estimate are  
10 formatted as a row in a table suitable for inclusion in a spreadsheet-like layout.

Referring to the flow chart shown in figure 3, state box 50 represents initialisation of the bill of materials module 12. Once initialisation is complete, the first menu, component menu M8, is displayed as shown at state box 52. The interface means 28 then waits for the user to make a selection, as shown at  
15 state box 54. Once a selection has been made, the selection is stored and if required, the menu and selection are concatenated and stored as part of the index, shown as state box 56.

Next, a comparison is made to determine whether the menu previously displayed was the last menu, shown as state box 58. In the menu was not the  
20 last menu, the next menu is determined from the selection made by the user, and the menu is then displayed, as shown in state box 60. The software then waits for the user to again make a selection at state box 54.

If the comparison at state box 58 determines that the previous menu was the final menu, the reference database 10 is searched using the index to locate the  
25 data relating to the material, shown at state box 62.

The control data is then interpreted by the processing means 34 as shown at state box 64. If the control data indicates that the other data contained in the

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reference database 10 represents the man-hours, then the data and the man-hours are simply forwarded to the output means as shown at branch 66.

Alternatively, if the control data indicates that a formula is to be referenced, the other data is used by the processor means 34 to reference the formula database 42 and the formula adjustment database 44 if required. The formula is then evaluated to calculate the man-hours as shown at state box 68. The data obtained from the reference database 10 and the man-hours are then output to the output means 36 as shown at branch 70.

The output means 36 formats the selections, the data and the man-hours into a format suitable for use by the direct cost estimate module 14 as shown at state box 72.

Finally, the software returns to the start 50, as shown at state box 74.

The direct cost estimate module 14 receives the selections, the data and the man-hours estimate from the output means 36 and displays the same in a spreadsheet-like fashion, as a list of materials and man-hours required for the project. The direct cost estimate module 14 includes functions such as copy and paste so that where more than one particular component is required, a user can simply copy and paste a previous selection from the bill of materials module 12 rather than repeating the selection process through the menus.

The direct cost historical database 16 contains a database of previous bills of materials, from which materials and groups of materials are selectable from the direct cost estimate module 14. For example, if a pumping station with a 10 kilolitre per minute capacity is required, the direct cost historical database 16 is referenced to determine whether the same or a similar pumping station has previously been included in a bill of materials and if so, the materials can simply be copied from the previous bill of materials rather than requiring the user to



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reselect the materials. In addition to saving time by referencing previously-used bills of materials, consistency between bills of materials is improved.

Further, the direct cost estimate module 14 references the direct cost adjustment database 17, so that if some materials are copied from a previous bill of materials, the cost of those materials can be updated from the direct cost adjustment database 17, providing a more accurate cost estimate.

The indirect cost estimation module 18 and the indirect cost historical database 20 operate in a similar manner to the direct cost estimation module 14 and the direct cost historical database 16, however the indirect cost estimation module 18 does not reference the bill of materials module 12. The indirect cost estimation module 18 presents a list of possible indirect costs to the user, which the user can then either enter indirect cost values or delete from the list. Once the direct cost and the indirect cost estimates have been completed, the cost estimates are output to the estimate summary 22, which displays the cost estimate information in a variety of levels of detail and formats.

The project cost control module 24 is intended for use when the engineering project is being constructed and is used to schedule the project, for procurement of the materials, and monitoring and management of project costs.

As the actual costs of the engineering project become known, they are entered into the project cost control module 24. At the completion of the project, the actual and estimated information is output to the cost comparison means 25 which creates entries in the direct and indirect cost adjustment databases 17 and 21 corresponding to any difference between the estimated and actual cost for future reference.

In addition, information from the project cost control module 24 is output to a comparison means 46. The comparison means 46 compares, for each material, the estimated man-hours for installation and the actual man-hours for

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installation. The comparison means 46 adjusts the formula adjustment database 44 for that material to reduce the error between the estimated and actual man-hours value.

It should be appreciated that the scope of the present invention is not limited to  
5 the particular embodiment described above.

For example, it is envisaged in other embodiments that the interface means 28 includes a further menu in which a user enters the height at which a material will be installed, which height information is then utilised by the processing means in calculating the man-hours for installation.

- 10 Alternatively, it is envisaged that in other embodiments, the control data will contain further instructions which the processing means will interpret as requiring the user to be prompted for information such as the height at which a material will be installed. The height information will then be utilised by the processing means in the formula when calculating the man-hours for installation.
- 15 Furthermore, it is envisaged that in further embodiments one or more of the selections are directly passed to the processing means for utilisation in calculating the man-hours required to install the component.

Finally, whilst the embodiment has been described with reference to carbon steel piping to American standard, it should be appreciated that this is an  
20 example only of one application of the embodiment and that the embodiment is equally applicable to other types of piping, as well as other material types, such as electrical, electronic, mechanical and structural materials. Where other material types are included, the number of menus and the menu headings vary depending upon the material type.



CLAIMS

1. A hierarchical relational definition system for defining an object, comprising:

interface means that sequentially presents a plurality of menus from which  
5 selections are made, each selection forming an input parameter, said input parameters corresponding to an object;

indexing means which forms an index from at least one of the input parameters;

database means including fields in which data relating to said object is  
10 stored, one of the fields including control data;

referencing means arranged to reference the database means using the index to obtain therefrom the data relating to the object;

processing means responsive to said control data, said control data including instructions to control whether the processing means references  
15 a formula and calculates further data relating to said object; and

output means for creating an output corresponding to at least one of the input parameters and/or at least some of the data and the further data, if any, said output defining the object.
- 20 2. A hierarchical relational definition system as claimed in claim 1, wherein each combination of input parameters represents a different object.
3. A hierarchical relational definition system as claimed in claim 1 or 2, further comprising a formulae database referenced by the processing means to obtain the formula.
- 25 4. A hierarchical relational definition system as claimed in claim 3, further comprising a formulae adjustment database, in which adjustments to each

formula in the formulae database are stored, said processing means also referencing said formulae adjustment database when calculating the further data.

- 5 5. A hierarchical relational definition system as claimed in claim 4, further comprising a comparison means, responsive to the output and to actual data provided by a user corresponding to actual values of the further data, the comparison means altering the adjustment corresponding to the object in the formulae adjustment database to reduce any difference between the actual data and the further data.
- 10 6. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein the processing means is also responsive to at least one of the input parameters and/or at least some of the data when calculating the further data.
- 15 7. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein only one selection is made from each menu.
8. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein the index is formed from a plurality of the input parameters.
- 20 9. A hierarchical relational definition system as claimed in claim 8, wherein the index is formed from the concatenated values of the plurality of input parameters.
10. A hierarchical relational definition system as claimed in claim 4, wherein the database means and the formula adjustment database each comprise a table.
- 25 11. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein the output means comprises table generation

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means which produces a table comprising at least one row, each row corresponding to an object and containing the input parameters and the further data.

- 5 12. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein the control data includes information as to whether a user is to be asked to enter data relating to the object.
- 10 13. A hierarchical relational definition system as claimed in any one of the preceding claims, wherein the control data includes information as to whether a field in said database means comprises the further data for the object or a further index to be used in referencing the formula.
14. A method for defining an object, comprising the steps of:
- sequentially presenting a plurality of menus from which selections are made;
- forming an index from at least one of the selections;
- 15 referencing a database using the index to obtain therefrom data relating to the object, some of said data being control data;
- determining from said control data whether to reference a formula to calculate further data relating to the object, and if so, referencing said formula and calculating said further data; and
- 20 presenting at least one of the selections and/or at least some of the data and the further data, if any, as an output, wherein the output defines the object.
15. A method for defining an object as claimed in claim 14, including the step of referencing a formulae adjustment database to obtain therefrom an
- 25 adjustment for said formula, which is utilised in calculating the further data.

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16. A method for defining an object as claimed in claim 15, including the step of comparing the further data with an actual value provided by a user, and on the basis of the comparison altering the adjustment corresponding to the object to reduce the difference between the further data and the actual value.
17. A method for defining an object as claimed in claim 14, 15 or 16, wherein the index is formed from a plurality of the selections.
18. A method for defining an object as claimed in any one of claims 14 to 17, including the step of requesting a user to enter data relating to the object if indicated to do so by the control data.
19. A cost estimate system comprising:
- means for producing a direct cost estimate; and
- means for producing an indirect cost estimate, including a hierarchical relational definition system according to any one of claims 1 to 13.

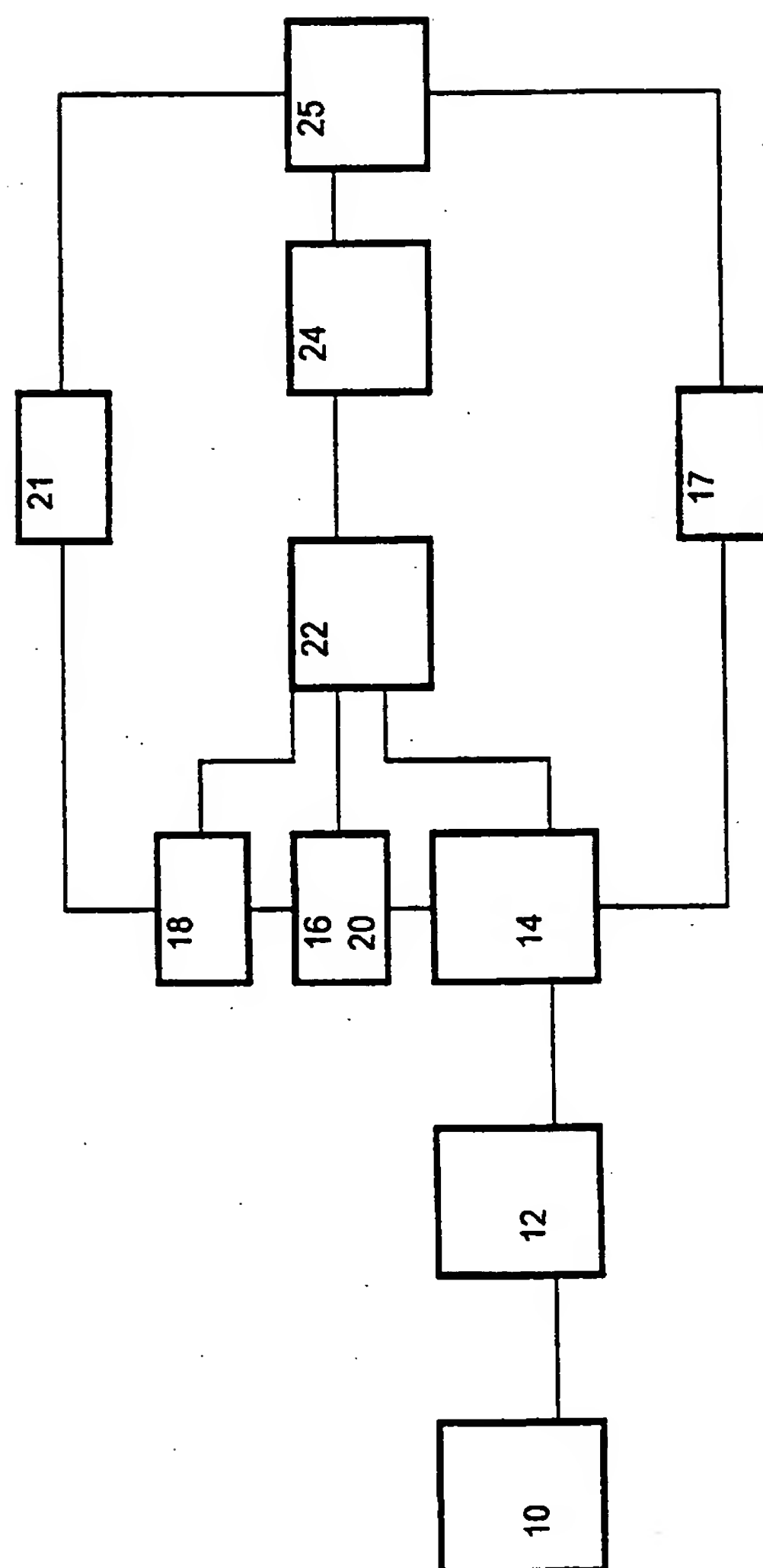


Figure 1

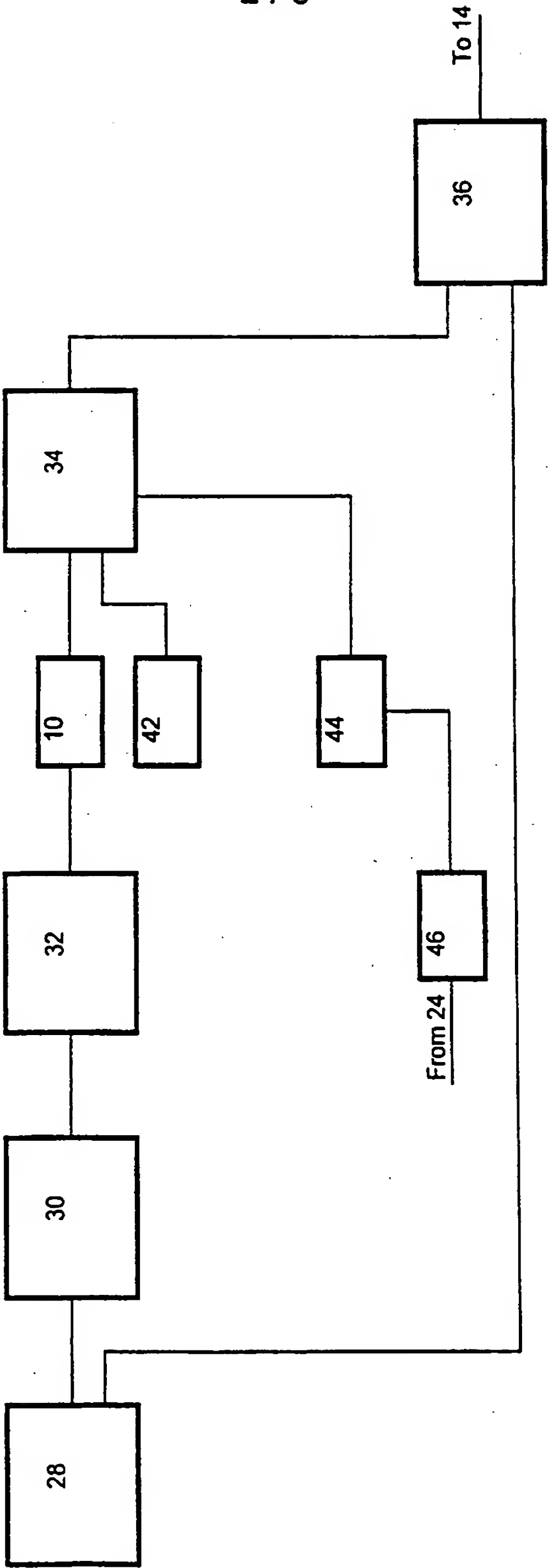


Figure 2

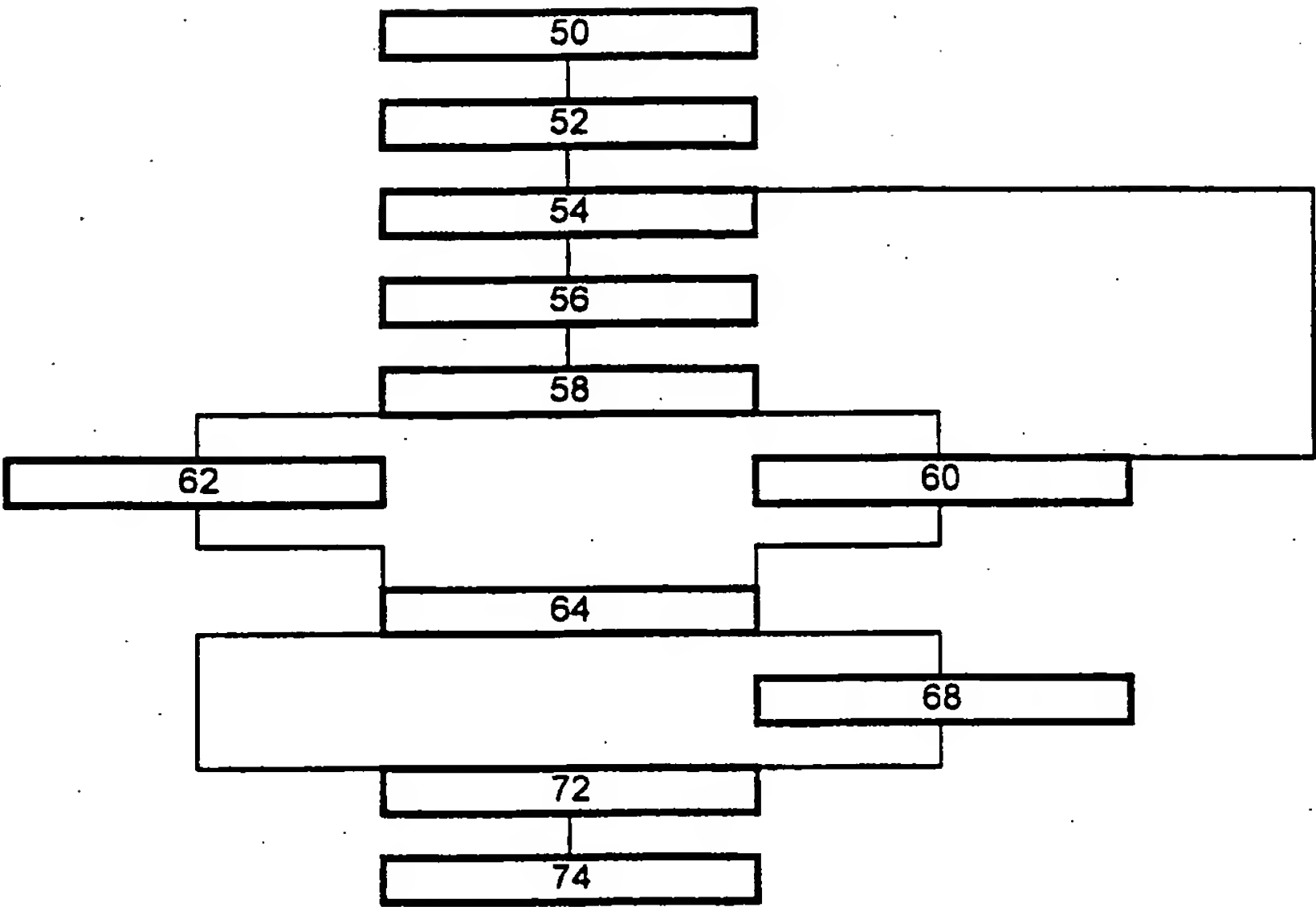
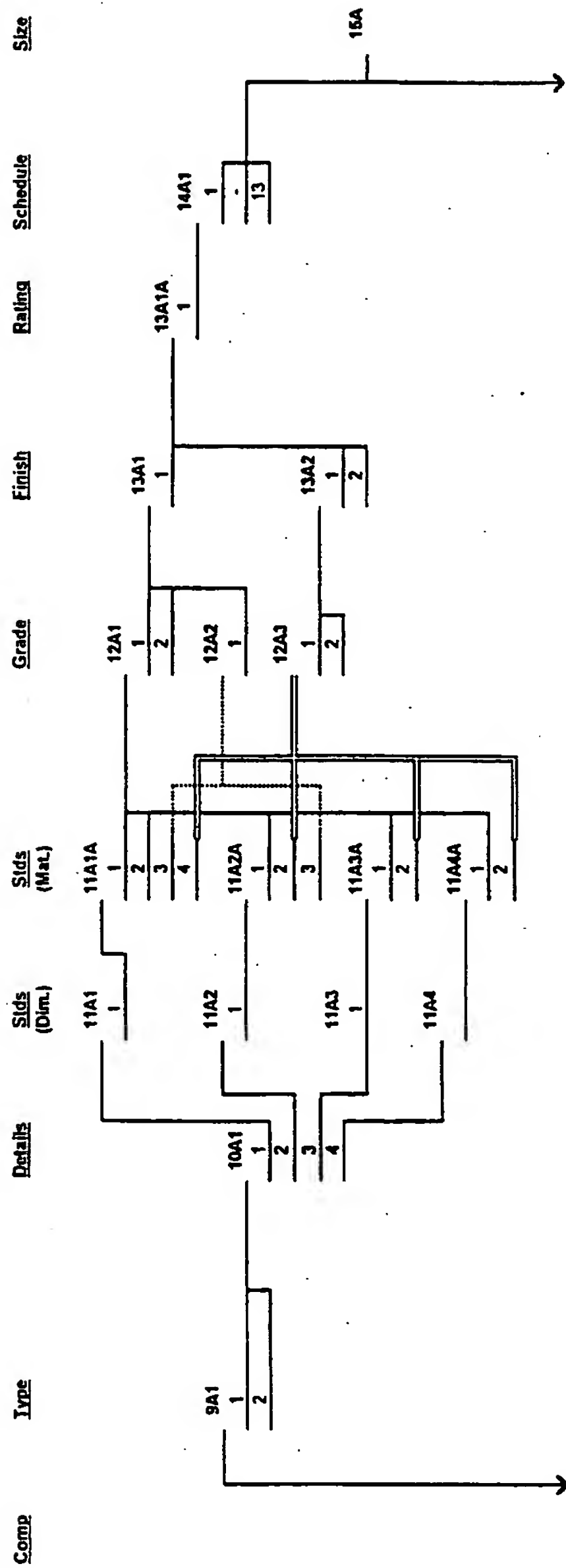
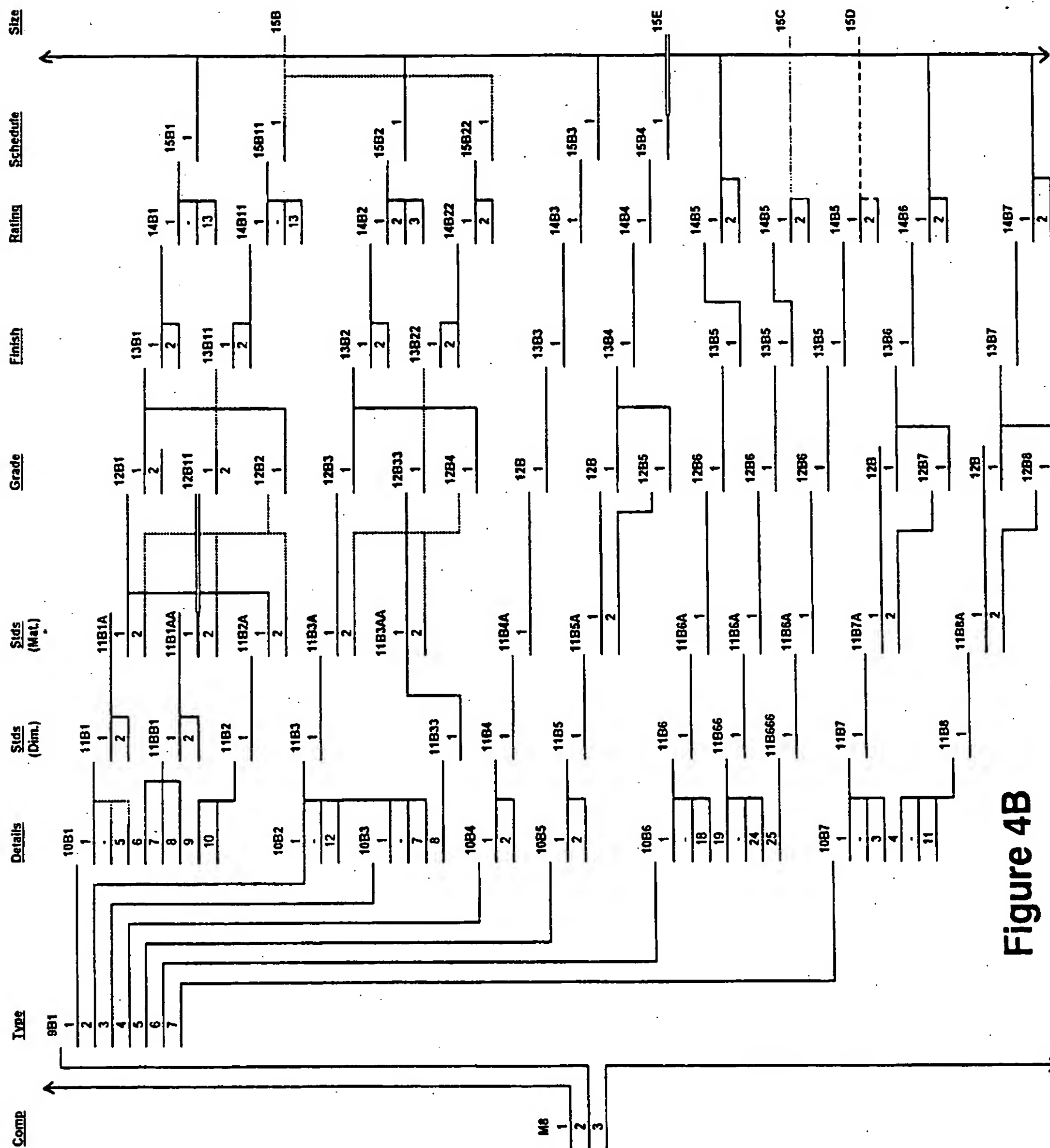


Figure 3



### Figure 4A





## Figure 4B

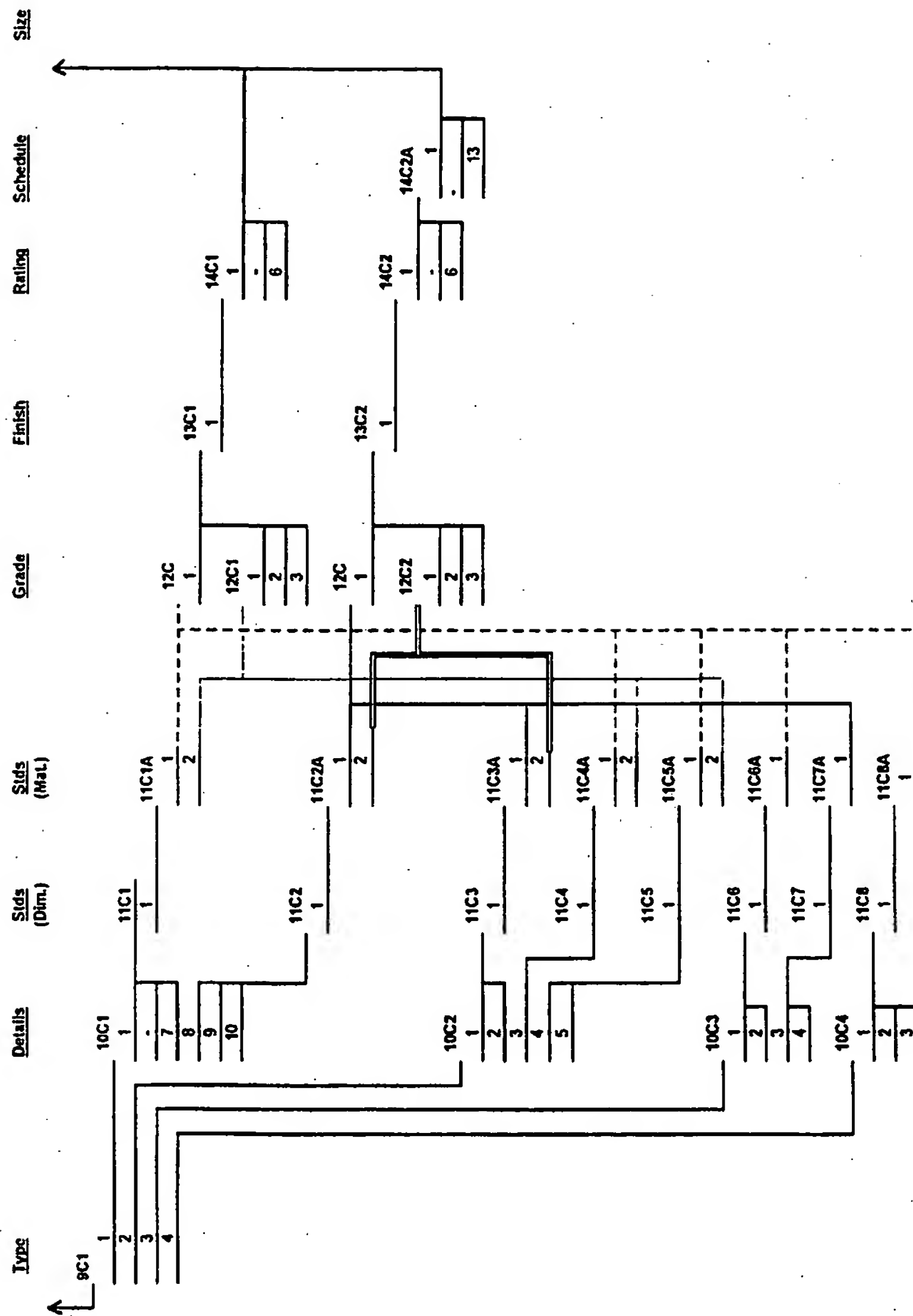


Figure 4C

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/AU 98/00038

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
Int Cl <sup>6</sup> : G06F 17/60, 17/30		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) IPC Int Cl <sup>6</sup> G06F 15/18, 17/30, 17/60 and Int Cl <sup>5</sup> G06F 15/21, 15/40		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT - price: or cost: or expense#		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 972 318 (BROWN et al.) 20 November 1990 See whole document but in particular column 6 line 32 to column 7 line 25	1-3, 6-14, 17-19
P, A	DERWENT ABSTRACT ACCESSION NO. 97-26041/24, CLASS T01 JP 09091337 A (ARAYAMA) 4 April 1997	
A	DERWENT ABSTRACT ACCESSION NO. 96-192961/20, CLASS T01 JP 08063518 A (MISAWA HOMES CO. LTD) 8 March 1996	
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C <input checked="" type="checkbox"/> See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 20 February 1998		Date of mailing of the international search report <b>3 MAR 1998</b>
Name and mailing address of the ISA/AU AUSTRALIAN INDUSTRIAL PROPERTY ORGANISATION PO BOX 200 WODEN ACT 2606 AUSTRALIA Facsimile No.: (02) 6285 3929		Authorized officer  <b>J.W. THOMSON</b> Telephone No.: (02) 6283 2214

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/AU 98/00038

C (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DERWENT ABSTRACT ACCESSION NO. 96-192960/20, CLASS T01 JP 08063517 A (MISAWA HOMES CO. LTD) 8 March 1996	
A	DERWENT ABSTRACT ACCESSION NO. 96-346951/35, CLASS T01 JP 08161392 A (MISAWA HOMES CO. LTD) 21 June 1996	
A	DERWENT ABSTRACT ACCESSION NO. 97-073446/07, CLASS T01 JP 08319718 A (TODA KENSETSU KK) 3 December 1996	
A	US 5 432 904 (WONG) 11 July 1995 whole document	
P, A	WO 97/22939 (BRITISH TELECOMMUNICATIONS PLC) 26 June 1997 whole document	

## Information on patent family members

**International Application No.**  
**PCT/AU 98/00038**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
WO	97/22939	AU	13840/97
		GB	9526096

END OF ANNEX